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THE ART OF BREEDING LIVE-STOCK.

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THE varieties among domestic animals of the same rootstock are obvious to the most casual observer. The Clydesdale or Shire horse is a very different animal from the thoroughbred, the Shorthorn cow from the Jersey, or the greyhound from the Skye terrier. All are the products of man's intervention through long and continued selection in breeding for certain objects—the Shorthorn for beef and the Jersey for milk, the draught horse for heavy work, the racehorse and greyhound for speed, and the Skye terrier to follow the fox to his den and to attack him when he gets there. In all these cases, particularly so in the case of the dog, a long period of years has intervened. Nevertheless, by taking advantage of slight accidental variations and accumulating them for successive generations on the principle of heredity, man has brought these animals to their present standard of excellence. The key to this is that nature supplies successive variations, which when guided in any definite direction give amazing results, not only modifying a herd or flock, but changing it altogether in any direction to meet requirements or popular ideals. Perhaps no better instance of the

influence of heredity and selection can be given than the precise and scientific experiments conducted by Darwin, by which he showed conclusively that all the races of domestic pigeons, of which there are some two or three hundred, are derived from one common ancestor, the wild or blue-rock pigeon; and, further, that pigeon-fanciers can always obtain fresh varieties in a few generations by careful selection, cross-breeding, and inbreeding.

From these considerations it might almost appear that the creating or modifying of new breeds or types amounts to little more than a mechanical performance — the moulding of some animated plastic material at the will of the operator. It will be shown later that this is by no means the case. Even the most skilful breeders are opposed in their operations by many intricacies, and have to reckon with manifold factors which are as yet secrets of nature. Even when by the progress of biological science some of these unknown factors may be determined, the art of selection would still be confined to comparatively few.

In whichever class of stock the breeder intends to specialize he must decide upon a standard which should be his constant aim to reach. This standard may be original, as was the case with the Sittyton Shorthorns, or it may be based on what may be termed public opinion. Seeing that the show-ring and the commercial value of most stock form the deciding factor, the latter standard is the safer. The principles never to be lost sight of after deciding on type may be stated thus: Breed to a standard of excellence which in time it is hoped to reach—it is always well to aim at the top; breed from parents which conform well to that ideal standard, always keeping in view the correcting of any defects in either parent in the offspring; select sires in particular from long-established purebred stock; and never lose sight of constitution and vigour or depart from type.

SELECTION AND PEDIGREE.

The art of selection in breeding is the ability to select animals which will propagate their kind so as to reach and maintain the standard of excellence aimed at. The importance of this ability to the breeder cannot be overestimated; it is indispensable to the highest success. It is a somewhat rare gift, largely intuitive; it frequently appears to be hereditary, but, nevertheless, is capable of cultivation to a high degree. The master hand of a breeder thus endowed is reflected in his flock or herd, and is at once recognizable by the general uniformity and high standard of his animals. By selection he has succeeded in combating to a large extent the tendencies to undesirable variation, eliminating defects, and at the same time gradually raising his herd or flock towards

his ideal standard of excellence. Selection is largely the key to the art of breeding, but successful breeding does not depend on this only. Pedigree is conjointly and equally important, and even then transmission to the offspring is frequently contrary

SOME VARIETIES OF PIGEONS.

1. Homing Pigeon. 2. Tumbler. 3. Carrier. 4. Barb. 5. Pouter. 6. Fantail. 7. Salinette. 8. Turbiteen. 9. Jacobin. 10. Trumpeter.

[*From "An Easy Outline of Evolution."*

to expectation. Pedigree is most reliable as a guide to selection where it shows the largest number of animals of high merit, particularly so in near ancestry. Without due regard for pedigree selection alone would be hopeless. Together with pedigree, individual merit, more especially in the sire, must never be overlooked.

It is usual to regard the sire as representing half the flock or herd, and in the writer's opinion the influence is often considerably more. When selecting a sire it is, therefore, of first importance, while keeping in mind the desirability of obtaining an animal likely to lessen defects in the flock or herd, that he should be of good pedigree, the desired type, of strong individuality, and vigorous. It is well recognized among breeders of high-class pure-bred stock that by mating a superior dam with an inferior sire the offspring is frequently inferior to either, but when the sire is superior the offspring is often superior to either parent. It is by mating on the latter lines that development of the breed goes on.

Since the revival of Mendelism much has been said and written as to its application to animal-breeding. It is more than probable that some of our eminent breeders may have unconsciously made their selections on similar lines to those of Mendel's law, and with equally good results. In any case the application of the accepted principles of selection, so far as animals are concerned, is only common-sense in the hands of capable men possessed with the necessary knowledge and the gift of observation.

It is an interesting fact that the art of selection and knowledge of the habits of animals is, as a rule, acquired during early boyhood on the farm, where the animals are the lad's hobby. It is here, and not from books, that the future successful breeder and judge of stock acquires — at first unconsciously — the gift of mastering the details of structure and the peculiarities of breed, constitution, &c. Few men who have not been intimately associated with stock-raising as boys can hope to take first place as judges or as successful breeders of high-class pedigree stock. To the average city dweller a flock of sheep appears as a number of animals all alike, but to the trained eye no two are alike. It is nothing unusual for a promising lad, reared on the farm, to distinguish not only each individual ewe in a fairly large stud flock, but to identify the lamb of any ewe with almost equal certainty. In either case the breeder who aims at the highest success in his work must have a wide grasp of the subject, and, considering the intricacies of the science of breeding, it is not surprising that the number of men who have distinguished themselves as breeders are comparatively few as compared with those successfully engaged in commercial and other pursuits.

PREPOTENCY.

A dominant feature in the mind of the skilful breeder when selecting animals, particularly so when choosing males, is the likelihood of their ability to transmit and perpetuate their own

characteristics to their offspring. The result of this, even to the most skilful, is sometimes manifestly disappointing. Nevertheless, the trained eye, aided by a thorough knowledge of pedigree and the history of the family to which the animal belongs, can discriminate and determine with a fair amount of certainty as to which animals are most likely to convey their prepotent influence to their offspring. The prepotency in a flock or herd can best be gauged through close study of pedigrees and the general similarity of the characteristics of the various animals, care being taken to make due allowance for any culling of undesirables.

The individual prepotent quality in the sire as a rule most concerns the breeder before making a purchase, and even after having satisfied himself as to pedigree, conformity to type, vigour, constitution, &c., he must still remember that animals of marked prepotency are difficult to obtain, and that there is no certainty as to how any such animal will mate. The discreet breeder of high-class animals will take no risks with an inbred sire, but will first mate him with a few well-bred females until he sees how they "nick" with him. Cases could be cited of a single sire having set back a herd or stud for years, and others where a single sire has brought a struggling breeder into the front rank and competency.

Similarity in breeding is no guarantee, nor can prepotency be assured as the outcome of any particular method of breeding. Again, some animals will transmit the qualities of their ancestors rather than their own, and occasionally very mediocre sires have proved to be sires of noted prizewinners. Stock-breeding is a science and an art in high degree, nevertheless much remains "not understood."

There are certain laws, however, which considerably modify the uncertainty of direct prepotent transmission from parent to offspring. Chief among these is heredity, or the law of inheritance, under which parents transmit their own or their ancestral characteristics with almost unfailing regularity. Take, for example, sidebone or spavin in the horse. The man who engages a stallion affected with either of these forms of unsoundness because he is cheap will find him a dear horse in the long-run. It is only a matter of time when the owner of the hereditarily unsound stallion will be forced out of business. On the other hand, any one who is interested in the breeding and performances of racehorses is familiar with names such as Soult, Martian, or Lupin, and those of the progeny of these animals. The number of winners among their individual progeny is remarkable. Regarding conformation,

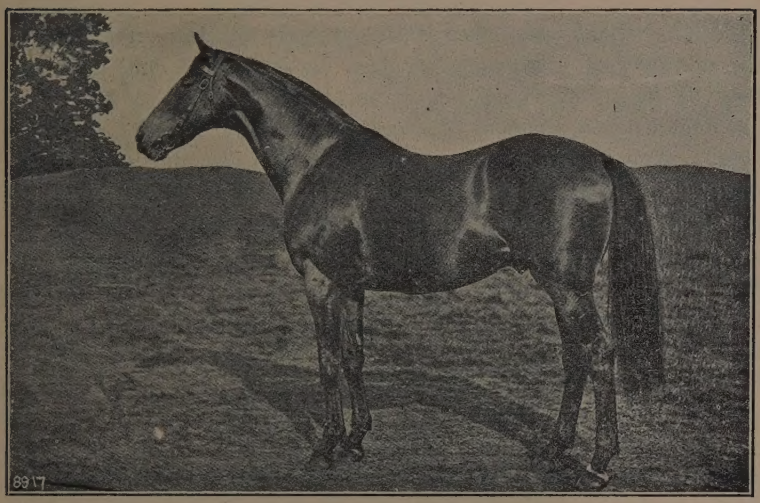
characteristics, &c., it is a well-known fact that there are men who can almost unerringly pick the progeny of these famous sires wherever found. Take, again, the fine handling-qualities of the Polled Aberdeen-Angus cattle. The beautiful touch of these animals is an hereditary characteristic of the breed, and is so marked that those accustomed to handling them could without difficulty select them from all other breeds on touch alone.

HEREDITY AND REVERSION.

The generally accepted law that "like begets like," or tends to do so, has an important bearing on the principles of heredity, and although it is subject to variation, no doubt largely influenced by the tendency to reversion or throwing-back, it is an important factor in breeding. It is, however, by no means certain: most breeders have experienced that with the progeny of two parents of the highest excellence and mated on this principle, one may be in every way up to expectation, and the next very ordinary, with no resemblance to either parent. This is one of the inexplicable problems of breeding, and is possibly due to the influence of the law of reversion, against which even the oldest-established breeds are not altogether proof. On general principles, however, the law of "like begets like" is sound

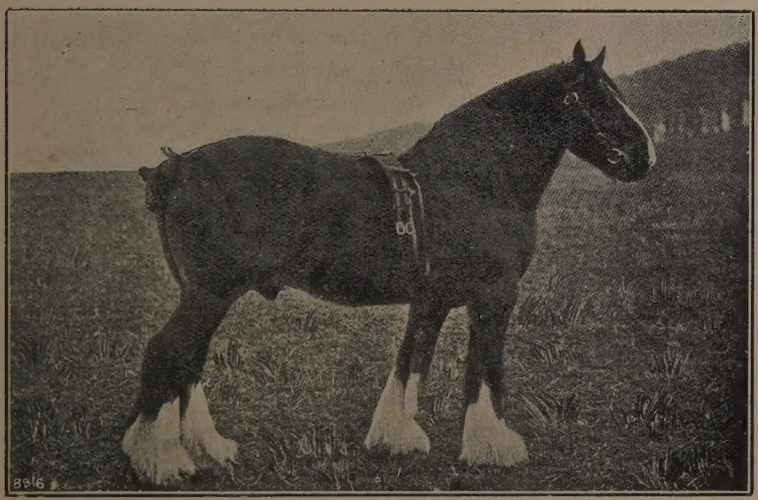
In cases where some of the progeny of high-class stock so mated do not fully meet expectations they should not be discarded without a trial. Experience has shown that their "get" by a properly selected sire or dam have excelled that of either their present or any of their immediate ancestors. It may be accepted generally that with both parents well bred and nearly alike in their essential characteristics the breeder can with a fair amount of certainty expect the dominating characteristics of the parents to be present in the progeny.

On account of the erratic nature of its action atavism is one of the most perplexing problems in connection with breeding. There can be no effect without a cause. Some hold that the cell theory accounts for reversion. It may be so, but this is too intricate a subject to be entered upon here. In the absence of a better reason it may be suggested that reversion is possibly due to some latent pre-existing characteristics of the breed. Instances which have come under the writer's personal notice are an occasional red calf, or scurs and even horns, in the best Polled Aberdeen-Angus blood; and in Shorthorns of equally good family a pure-white calf (generally a good one), and others with brown muzzle or dark spots on the nose.



THOROUGHBRED STALLION, "DIAMOND JUBILEE."

Won the Derby in 1900 for the late King Edward (then Prince of Wales).



SHIRE STALLION, "BIRDSALL MENESTREL."

Tring Park Stud, England.

[*From "Stephens's Book of the Farm."*

VARIATION.

It is evident that even with a good working knowledge of the principles of prepotency, heredity, like-begets-like, and reversion, there is much uncertainty in mating animals so as to reach and maintain a given standard of excellence. Nature is truly a "fickle jade." Notwithstanding the apparent difficulties and uncertainty, there is one law — that of variation (which again almost indicates contradiction) — in which the skilful breeder holds a powerful aid in moulding the character of his flock or herd towards his ideal standard, or even in creating a new type. Were it not for the principle of variation in the law of heredity purebred animals would have long ago become so much alike that improvement in breed or type would have ceased.

Apart from the influence of transmission, the factor of environment — changed conditions, food, climate, &c. — is well known to change the character of animals to a marked degree. The Romney Marsh sheep in New Zealand is a good example. When bred and reared on rich, low country, similar to its original home, it maintains well its original characteristics, with perhaps some improvement in vigour and closeness of fleece; but when transferred to comparatively high, good pastoral country its general characteristics are markedly changed in a few generations. In conformation it has changed, but without deterioration; constitution has as a rule improved; both wool and carcase are of the highest commercial value; and the breed becomes, in fact, practically a new type evolved largely under the law of variation.

There is another feature in variation, equally important but relating more to the development of new breeds. No two animals are exactly alike. Some show marked signs of improvement in some particular characteristics over those of their parents, while others are retrogressive. It is here the skilled breeder holds the balance whereby he can either improve on existing type or by selecting on any particular feature and propagating same through inbreeding evolve in time a new type. A good example of such breeding combined with changed environment, climate, &c., is that of the Sittyton Shorthorn. In this case Cruickshank by careful selection on the variation principle produced his ideal butcher's beast. From a combination of the Bates and the Booth strains he evolved a type different from either, which for character, constitution, and success in the show-ring against all-comers is famous in all beef-producing countries.

INBREEDING AND LINE-BREEDING.

An important and much-debated factor in connection with the mating of new breeds or types is that of inbreeding. It is well known that what is termed in-and-in breeding has in the history of most pure breeds been largely practised, thereby hastening their establishment to a marked degree. Nevertheless, with a full knowledge of many of the wonderful results from inbreeding in the hands of skilful men, the writer, for one, has always held that although the hastening of fixed type and character cannot be denied, equally good results could possibly have been obtained in a little longer time by mating animals of more distant blood relation. We see what has been accomplished, but exactly what has been lost in constitution, size, and vigour is difficult to estimate.

One thing is certain: whatever may have been the benefits or the necessity for this form of inbreeding in the past, any such necessity, now that our pure breeds are so well established, is past. It is granted that, in order to better perpetuate desirable characteristics when they do happen through variation, the opportunity should be seized by judicious inbreeding with animals not too closely related and possessing the desired qualities, leading to the ideal standard of excellence. This is quite another matter to repeated in-and-in breeding on the nearest blood relations, a practice which should not be attempted unless by those possessing a sound scientific training, and then only for purposes of sufficient importance to warrant its being undertaken.

The mating of animals of the same family and more or less distantly related is, however, largely practised by experienced stock-breeders. Up to a certain point, if practised with good judgment, what is known as line-breeding does bring about greater uniformity of type, and from a herd or flock so bred higher general prepotency may reasonably be expected. But, as with closer inbreeding, if line-breeding is persisted in difficulties and disappointments begin to appear. The first, as a rule, is the absence of or the decrease in the number of champion or first-prize tickets. True, the herd or flock will be still of high merit, but there will be few of its members that excel or are possessed of that outstanding individuality which prior to the commencement of line-breeding in the established flock or herd was fairly frequent. The reason is not far to seek. All animals have their individual characteristics, which may be termed good and bad, some visible and some latent; the result being that the breeder, notwithstanding his skilfulness, by confining himself to fairly close line-breeding

has perpetuated both qualities. He has thus practically outbred variation, and finds himself with a lot of doubtless nice animals, but of not sufficient merit to warrant special attention.

If the practice be continued, the next stage, as a matter of course, is that deterioration begins to make its appearance, and want of vigour and general sickliness of countenance become perceptible to the trained eye. Even in cases where line-breeding has been carried too far the position is, however, by no means hopeless. The remedy is to "outcross" as quickly as possible by introducing fresh blood. In this, again, both skill and judgment must be used. As previously mentioned, a fresh sire for a valuable herd or flock should be introduced with caution until it is seen how he nicks with a few well-selected females. If right, it has been found that restoration is almost magical, the general stamina being revived, and prizewinning animals being bred once more.

CROSS-BREEDING.

This may best be considered under two heads: (1) Crossing two distinct breeds of purebred animals — for example, the Aberdeen-Angus with the Shorthorn; (2) crossing purebred males — say, Aberdeen-Angus or Shorthorn — with an ordinary herd of females of mixed blood.

In the former case, if the cross is intended for a special purpose —perhaps increased beef-production or to win some prize, or as a foundation for a new breed—it may be justifiable. The first cross will probably be an improvement on either the sire or the dam. But as experience has shown that subsequent crosses from purebred animals on both sides are liable to undesirable variations, it is difficult, except under special conditions, to advance any sound reason for crossing distinct pure breeds when each should be valuable for maintaining in its own class. This is all the more so when equally good results can be obtained by mating a well-selected purebred sire of the class desired with females of mixed blood, showing the necessary conformation and general characteristics of the type to be produced. Further, it is well known that while in the former case undesirable variations and general decadency are frequently noticeable after the first cross, in the latter case an improved type is perpetuated in subsequent crosses.

Probably no one knows the difficulties encountered in creating a new breed better than the successful breeders of the Corriedale, who, after considerably over a quarter of a century of selection and constant care have succeeded in evolving this wonderful sheep.

ENGLISH SHORTHORN COW, "SWEETHEART."

JERSEY COW, "LADY VIOLA" (ENGLAND).

[*From "Stephens's Book of the Farm."*

With sheep, more particularly in regard to wool-production, certain cross-breeding should not extend beyond the first cross—for example, Shrop and other dark-faced rams on longwool ewes. This first cross is well known for its excellence in fat lambs and early maturity, but every sheep-farmer knows by experience that to perpetuate this cross would be fatal to his flock. The benefits of using purebred rams for flocks of mixed blood and breeding are well known in this country, where our flock ewes are the outcome of mixed breeding, and represent mixed blood of the Romney, Merino, Border Leicester, English Leicester, Lincoln, and other longwool breeds. The result of this practice is that whatever the breed of purebred ram the ewes are mated with, whether longwool or Merino, provided the sheep are suited to the country on which they are running—or, rather, the country is suitable for them—we find a steady improvement from generation to generation, presuming, of course, skilful selection of rams. The general high standard of quality of New Zealand wool, mutton, and lamb may be evidenced in support of the system of sheep-breeding by crossing ewes of mixed blood with purebred rams of a high standard for both the production of mutton and wool.

The benefits of cross-breeding with purebred to mixed blood are, indeed, generally recognized. A case is within the writer's personal experience where by breeding on the lines here referred to—using well-selected purebred bulls of the best blood in Great Britain on a herd of crossbred cows—the value of the progeny so bred increased in value by about 40 per cent. in ten years, and the cattle were prime beef quite three months earlier than originally.

Experience having shown the results from the two methods of crossing to be so different, the question arises as to what is the explanation. This is a matter for the scientist, but the position may be popularly stated somewhat as follows: In the first case, that of the two distinct breeds (both pure), we have the Aberdeen-Angus representing, say, 95 per cent. units; Shorthorn representing, say, 90 per cent. units (the balance in both cases being mixed blood). The breeds being nearly equal, there is a pitched battle for supremacy, and as a result much variation and considerable reversion towards the original types on both sides.

Again, take a cross between the Hereford and Aberdeen-Angus, where the colour and horns are a visible factor, and, assuming that both breeds are about equal in ancestry and prepotency, we find a battle royal for supremacy—white faces every time, no horns, colour generally black and later uncertain. And were it not for man's intervention by selection of future sires, from either

one breed or the other, the battle could continue by perpetuating the strongest characteristics at the expense of the weaker, and would ultimately end with the survival of the fittest.

On the other hand, in the second case, putting the purebred to mixed blood, we have, say, the Aberdeen-Angus with 95 per cent. units, and mixed blood representing, say, units of 15, 20, 30, 10, 25 = 100 per cent. It stands to reason that with a vigorous sire representing 95 per cent. of pure blood, mated with animals of mixed blood as indicated, the stronger must dominate the weaker, and in the unequal fight the latter must in a few generations give place almost entirely to the stronger. Hence the improved crossbred type in this form of crossing, and again the survival of the fittest.

ENVIRONMENT AND NEW LOCAL TYPES.

Notwithstanding what has been said regarding selection, prepotency, and pedigree in connection with the breeding of animals, success is impossible unless they are capable of adapting themselves to surrounding conditions or these conditions are conducive to their development. The influence of soil, climate, altitude, and locality has a most important bearing on the breeding of animals. Unless the environment is in every way suitable to the development of the breed and type decided upon the animals will, through adaptation, in a few generations evolve into another type better adapted to meet the new conditions. Take the production of wool: It is well known that even when the breeding is as nearly alike as possible the character of the wool produced in the various districts of the Dominion differs in texture, density, length of staple, &c., as does also the character and conformation of the sheep. Again, it is equally well known that it would be folly to attempt to run certain breeds of sheep on some classes of country, while other breeds would do well and maintain their best characteristics.

In the case of animals kept under artificial conditions, such as purebred cattle and horses when housed and fed with selected food, these are less dependent on soil or climatic conditions, and when transferred to a higher altitude and colder climate it will be found, as a rule, that their progeny generally show a marked improvement in constitution and general hardihood. In the case of the Sittyton Shorthorn it is recognized by those who are intimately acquainted with the early history of this famous herd that its success was to some extent due to the change of environment from a more temperate climate to a higher altitude and much colder climate, where under proper care the herd developed to its

renowned standard of excellence. As a general principle, however, a change of blood from a colder or higher altitude is preferable.

As regards the North of Scotland, the Sittyton herd as a foundation, and the rigorous climate combined with the art of breeding and feeding live-stock possessed by the owners of stud herds, are factors that have made that district the hunting-ground of the world for those in search of impressive sires. The writer has before him a letter from an old schoolmate of his own to a friend in this country who is a prominent breeder of Shorthorns in Aberdeenshire, wherein he mentions that between the months of May and September of the present year about 400 head of purebred Shorthorn cattle have been exported to Canada and the United States of America from his immediate locality. An export of this magnitude from a comparatively small area (and in the off season) should surely be an impetus to us in New Zealand, with conditions, both geographical and climatic, most favourable, to assert ourselves in the breeding of animals of such high merit as will bring increasing numbers of buyers from abroad in the same way as buyers have long been attracted by our wool and other produce. Good openings have already been made in the export of stud sheep to North and South America and Australia, and a promising trade is developing with Aberdeen-Angus cattle for Australia.

In the writer's opinion this country lends itself well to the establishment of new types which would possibly prove of great value to those concerned. Taking the nondescript breeds of the average herds in dairying districts, and assuming that the increased production of milk is the ideal aimed at, it ought to be possible to evolve a type better suited to local conditions and with a higher milk-yield. We may suppose the formation of an association to create a new type of dairy cattle suited for, say, Taranaki, bred on sound lines, the ideal being the production of milk combined with vigour and constitution. In a few generations Taranaki might become as noted for its special type of dairy cows as it is now for its pastures.

The suggestion of modifying or creating a type of dairy cattle or any other class of animals peculiar to a district has more to commend it than may at first sight appear. When it is remembered what has been done in this direction in other countries it may be recognized that the opinion regarding the establishment of new types is sound.

Nature insists upon one of two courses—adaptation to environment or extinction. Were it not for selection and the introduction

of fresh blood the influence of environment would in time establish a character and type peculiar to locality. Demonstrating the value of acclimatized animals (adapted to environment), sheep which have been bred for several generations on rather poor soil and at a fairly high altitude, where they have developed considerable structural changes, both in conformation and character of wool, are in every way more profitable than sheep brought from elsewhere.

In some districts in Scotland the conditions of the farm lease provide for the maintenance of the direct progeny of the sheep which were running on the land at the commencement of the lease, also that the same number of each class and sex as were taken over at the beginning of the lease shall be handed over at its expiry. Such a despotic form of lease would not be acceptable here with our liberal land laws, but the fact serves well to demonstrate that the principles of adaptation and environment have been recognized for ages.

Coupling adaptation and environment with selection we find the key to the foundation of such breeds of cattle as those of the Channel Islands, the English milking Shorthorn, the Ayrshire, the Friesian, and other European milking-breeds; while in sheep there is a distinct breed or type in every other county or group of counties in Great Britain. It would appear, therefore, that there is strong inducement for the creating of types peculiar to the different localities of New Zealand.

BLACK ORPINGTONS, MILTON POULTRY STATION.

POTASH IN AGRICULTURE.

II. SOME RECENT RESEARCHES.

B. C. ASTON, F.I.C., Chemist to the Department.

IN the October, 1915, issue of the *Journal* attention was called by the writer to the calculation by F. W. Clarke that the crust of the earth contained 2·45 per cent. of potassium (= 2·95 per cent. potash) and only 0·11 per cent. phosphorus, and it was suggested that the experience acquired during the present troublous times would be useful in showing how far the agriculture of this country would suffer through the artificial supply from Germany being cut off, a hint being also given that it might not be necessary to revert to the use of potash in such quantities as in the past. After this was written a most interesting account of the potash problem in England was published by Dr. E. J. Russell, Director of the Rothamsted* Experimental Station, who points out that artificial potash manures are of only recent use in Great Britain, into which they were imported for the first time about 1890, and that all the good farming of the eighteen-sixties was done without them. Two important potash-demanding crops, potatoes and mangels, have, however, been made possible on their present scale by the introduction of potash manures. A statement of mine that 18 tons of potatoes per acre were obtained from one of our State farms was once criticized as improbable by an old farmer, who had probably gained his experience prior to the introduction of potash manures. As a matter of fact, in Germany, where the farmers can obtain potash manures very cheaply, as much as 30 tons per acre are obtained.

Dr. Russell's advice to English farmers is very similar to that given in my article—viz., (1) to utilize other sources of potash than the Stassfurt salts, specifying the ashes of seaweed, bracken, hedge-trimmings, waste from sawmills, urine, farm-manure, and crop residues; (2) to render the reserves of potash in the soil available by indirect potash fertilizers, such as sodium and calcium (lime) salts. He also suggests that, although the use of the insoluble compounds of potash (feldspar, &c.) have hitherto proved disappointing in practice, experimenters might turn their attention to the effect of the silicates of potash when used in conjunction with common salt,

* *Journal of the Board of Agriculture*, August, 1915.

a treatment which my note on the solubility of the mica-schist soil of Otago after heating with salt and lime supports. In connection with the use of lime, it has recently been questioned by F. B. Guthrie,* Chemist to the New South Wales Department of Agriculture, whether lime liberates potash from the soil. A perusal of Dr. Russell's article does not give one any apprehension that the potash shortage in Great Britain will seriously affect the agriculture of that country, and if this is so for lands which have been intensively cultivated for centuries little fear may be felt for New Zealand.

A paper by Professor Hendrick† on the "Manure Situation and its Difficulties" points out that an immense amount of potash is at present lost in stock-urine, and estimates that liquid manure is worth in Scotland 6s. 3d. per ton, assuming potash to have doubled in price since the beginning of the war. His figures show that the liquid manure contains nitrogen (N), 0·204 per cent.; potash (K_2O), 0·462 per cent.; phosphoric acid (P_2O_5), 0·029 per cent. The same fertilizer here would doubtless be worth from 15s. to £1 per ton, judging by present prices. Mr. C. T. Gimingham‡ has drawn attention to the fact that flue-dust from boiler-flues and chimneys contains up to 10 per cent. of potash, and may be worth in England from £1 5s. to £2 10s. per ton. One may double or treble this value for New Zealand if the potash is present in the same proportion and potato-growers are willing to pay the inflated prices for it.

An interesting bulletin§ was written by Hopkins and Anmer, of Illinois University, U.S.A., with the intention of showing that potash need not be purchased at all for use on normal soils for the production of staple farm crops, but that it may be easily liberated in abundance by means of decaying organic matter, such as green manures, crop residues, and farm manure, which will also supply nitrogen and liberate phosphates from the soil, or make more available phosphates applied to the soil. These authors grew clover on soil which had been extracted by strong hydrochloric acid, and had therefore most of the "available" potash abstracted. The clover was able to extract more potash, corresponding to 158 lb. of potassium per acre, in the combined crops of three consecutive years. If this had been ploughed in it would therefore have supplied that amount of available potash to the soil.

POTASH FROM SEAWEED.

Attention has recently been drawn in New Zealand to the possibility of utilizing seaweed for manurial purposes, and it is inquired

* *New South Wales Agricultural Gazette*, October, 1916. † *Journal of the Board of Agriculture*, July and October, 1916. See also this *Journal*, October, 1915, p. 29. ‡ *Journal of the Board of Agriculture*, May, 1915. § No. 182, May, 1915.

whether light work for returned soldiers could be found in collecting and burning seaweed. Before anything definite could be said for such a scheme it is desirable that information regarding the available supply of seaweed and the botanical and chemical composition of it should be obtained, but it is not likely, even if the utilization of seaweed were proved to be profitable, that the work would be "light" or suitable for returned soldiers.

A sample of the seaweed *D'Urvillaea utilis* (not necessarily a fair one) recently analysed in this laboratory showed that the dried matter only contained 1·75 per cent. of potash and 0·7 per cent. of nitrogen, which would not be worth more than £2 per ton. F. K. Cameron, United States Department of Agriculture Bureau of Soils,* has given the following figures for *Macrocystis pyrifera:* Potash (K_2O), 12·59 per cent.; nitrogen (N), 1·57 per cent.; iodine, 0·23 per cent. F. T. Shutt, Dominion Chemist, Canada,† gives the composition of *Porphyra laciniata* as 0·619 per cent. potash and 0·928 per cent. nitrogen. Both of these seaweeds occur abundantly on New Zealand shores, but whether their composition here is similar to that found by Cameron and Shutt is a matter for further research. The researches of Cameron‡ and others show that the kelps growing on the Pacific coast of America are essentially different from the Atlantic kelps, and apparently from the kelps of Japan. They yield a much higher percentage of potash (five or six times that of the Atlantic), but have a much lower percentage of iodine. The authors estimate that these kelps can easily be made to yield upwards of a million tons of potassium chloride annually, worth at least 35 million dollars, and that the cost of production can be largely if not entirely covered by the value of the iodine and other minor products. The United States at the time referred to (1912) annually imported from Germany 12½ million dollars' worth of potash.

J. W. Turrentine's§ examination of eighty-one samples of dried seaweed from the Pacific coast may be quoted as useful. In analyses of eighty-one samples of oven-dried seaweeds from the Pacific coast the potash (K_2O) varied from 0·37 per cent. (equal to KCl—muriate of potash—0·59 per cent.) in the stipe of *Pterygophora californica* to 29·9 per cent. (equal to 47·5 per cent. KCl) in bulbs of *Pelagophycus porra*. "When the average potassium-chloride content of the twenty-nine samples of the northern kelps (from Puget Sound) is compared with that of the twenty-seven samples of the southern (from the region of San Diego), the respective values being 21·3 per cent. and 23·4 per cent., it appears that the content of the

* United States Commerce Report No. 143, 19th June, 1915. † Circular No. 7, 1914. ‡ Fertilizer Resources of United States, 1912. § Jour Indust. & Engin. Chem., 1912, p. 431.

Analyses of Seaweeds.

Giant Kelps.	Potassium Chloride (KCl).	Iodine (I).	Phosphoric Anhydride (P_2O_5).	Potash (K_2O).	Ash.	Organic Matter.	Water.	Nitrogen.	Analyst.	Remarks.
Nereocystis	32·6	0·14	..	..	..	..	..	..		
Macrocystis	22·2	0·27	..	..	..	..	..	..		
Pelagophycus	31·3	0·36	..	..	..	..	..	..	Turrentine	Calculated on oven-dried samples (U.S.A.).
P. porra	..	..	0·51	..	..	..	..	..		
Macrocystis pyrifera	..	..	1·84	..	..	..	..	..		
Pelagophycus porra (bulbs)	47·5	..	..	29·9	..	..	..	..		
Fucus furcatus	..	..	0·29	2·26	17·91	72·61	9·48	1·32		
F. furcatus	..	..	0·108	2·025	8·58	27·93	63·49	0·468		
F. vesiculosus	..	..	0·037	0·615	4·10	7·61	88·29	0·182		
Ascophyllum nodosum	..	..	0·070	0·619	5·56	19·30	75·14	0·273	Shutt ..	Canadian.
*Porphyra laciniata**	..	..	0·068	0·619	5·43	15·15	79·42	0·928	..	3·1 % N. on dry matter.
Laminaria longicruris	..	..	0·134	1·546	4·55	7·15	88·30	0·251	..	4·6 % N. on dry matter.
L. digitata (stems), 10 samples ..	..	..	..	1·830	6·33	12·31	82·37	0·23		
L. digitata (fronds), 8 samples ..	..	..	..	1·280	5·65	19·59	74·75	0·34		
L. digitata (dry matter, stems), 10 samples	..	..	..	10·49	..	64·03	..	1·31		
L. digitata (dry matter, fronds), 8 samples	..	..	..	5·25	..	77·28	..	1·30		
L. stenophylla (dry matter, stems), 4 samples	..	..	..	12·35	..	64·73	..	1·02	Hendrick	Averages (British).
L. stenophylla (dry matter, fronds), 4 samples	..	..	..	4·49	..	77·76	..	1·08		
Fucus vesiculosus (dry matter), 5 samples	..	..	..	3·07	..	79·71	..	1·18		
F. nodosus (dry matter), 6 samples ..	..	..	..	2·52	..	78·39	..	1·13		
F. serratus (dry matter), 4 samples ..	..	..	..	4·18	..	77·56	..	1·50		
*Macrocystis pyrifera**	..	0·23	..	12·59	..	..	..	1·57		
Nereocystis luetkeana	..	0·13	..	20·10	..	..	..	1·90	Cameron	Averages (U.S.A.).
Alaria fistulosa	..	..	..	9·10	..	..	..	2·60		
D'Urvillaea utilis	..	..	..	1·75	..	79·20	..	0·70	..	Author.

* New Zealand species.

southern plants exceeds that of the northern." However, choosing the four varieties in the northern collection which occur in the greatest quantities (the genuses *Nereocystis, Macrocystis, Postelsia,* and *Egregia*—nine specimens), the average KCl content is 25·7 per cent., and the two genuses of the north considered as a commercial source of potash, *Nereocystis* and *Macrocystis,* show an average content for six specimens of 29·4 per cent. The average content of the two specimens of *Macrocystis* from Puget Sound is 26·5 per cent.; that of the twenty-two specimens from the south is 21·6 per cent. "The average iodine-content of the thirty specimens from Puget Sound is 0·155 per cent., and of the four main varieties (ten specimens) is 0·14 per cent. The average of six specimens of the two giant kelps, the *Nereocystis* and the *Macrocystis,* is 0·16 per cent. The average percentage content of the southern kelps is 0·29, a value nearly twice that from the northern kelps." Of the three giant kelps *Nereocystis* contained on the average 32·6 per cent. KCl, 0·14 per cent. iodine; *Macrocystis* 22·2 per cent. KCl, 0·27 per cent. iodine; and *Pelagophycus* 31·3 per cent. KCl, 0·36 per cent. iodine.

In addition to the variations in composition between the varieties of kelps there was a marked variation between members of the same genus from different localities and from the same locality. There is also a variation strikingly shown in the case of *Pelagophycus* between the different parts of a single plant. These differences have been pointed out by Balch. From analysis of a limited number of kelps it was found that phosphoric acid varied from 0·51 per cent. in *Pelagophycus porra* to 1·84 per cent. in *Macrocystis pyrifera,* and sulphur from 1·08 in *Nereocystis leutkeana* to 3·45 in *M. pyrifera*.

The method used in America to turn kelp into a marketable manure is given by "Mining Industry," 1914, pages 620 to 623, of which the following is an extract:—

"At Point Loma, San Diego County, California, the Kelp Products Company has built an experimental plant to extract potash from kelp, and a larger unit to dry the plants for use as fertilizer. Under the process which the company has patented the plants are chopped very fine, a deglutinizing agent being fed into the chopper. The juices are then evaporated artificially and the salts allowed to crystallize. The kelp is harvested with a mowing-device which extends 6 ft. below the surface, and is carried by a conveyer on to the barge. This is towed ashore, and the plants are placed on a conveyer which carries them to a chopper which has been placed on the company's dock. From the chopper-discharge the material is moved by another conveyer to a rotary tubular calciner in which a sufficient heat is maintained to thoroughly dry the kelp. The dried

material is then ground and sacked. This equipment, which is already complete, is expected to produce kelp fertilizer commercially, and the owners expect to make shipments in May or June, 1915. According to officials of the company the finished product has an analysis of 15 per cent. K_2O, 2 per cent. N., and 0·5 per cent. P_2O_5. This company is evidently the only concern as yet to make any serious attempt to produce kelp fertilizers in the United States."

In Norway, where iodine is made from seaweeds, potash salts are obtained as by-products, and Knudson* ("Seaweed, Potash, and Iodine") maintains that a potash industry on the basis of seaweed will first and last depend on the content of iodine in the marine plants. The latest price-list of the British Drug Houses (Limited) (1st October, 1916) gives the price of iodine (resublimed) at £2 10s. per kilogram (2·2 lb.), whereas potassium chloride at present is 2s. 11d. per kilogram.

Other attempts to establish the kelp industry are being made in Great Britain and Canada. Professor Hendrick recently advocated making surveys of the seaweeds available round the coasts to determine the best methods of harvesting, cost of conveyance to convenient centres, and cost of artificial drying, the present methods being crude and wasteful, and the industry badly organized. In Canada, according to the *Fertilizers and Feeding-stuffs Press* of 22nd July, 1916, "the Canadian Potash and Algin Company (Limited), which was organized in 1915, and established a plant at Sydney, British Columbia, is now utilizing from 30 to 40 tons of raw kelp daily in the manufacture of fertilizers. The product is a fine, dry, but heavy powder. Plans are being made to enlarge the plant and install special machinery for the extraction of other materials from kelp. It is stated by the promoters of the industry that the manufacture of iodine and potash without the production of by-products would not prove very profitable in normal times, but the increase in the price, especially of potash, on account of the war will enable the British Columbia Company to include these and other by-products in the output of the factory at Sydney. The value of potash imported into Canada annually is about £200,000. It is estimated that the kelp-beds on the British Columbia coast contain sufficient material to manufacture potash not only for the local market, but for export also. An act relating to the licensing of kelp-reduction works, designed especially to encourage the development of the industry and for the protection of persons or companies desiring to engage in the business, was passed in the 1915 session

* Jour. Indust. & Engin. Chem., 1912, p. 623.

of the Provincial Legislature. The industry is under the jurisdiction of the Minister of Fisheries. A license protects the operation of any reduction factory for an area extending fifty miles along the coast."

Yendo (abstract in *Journal of Ecology*, Vol. 2, 1914, page 126) has drawn attention to the cultivation of marine algæ in Japan, where mariculture (agriculture in the sea) yields an annual value of upwards of a million pounds sterling, about one-third being exported to China. This plant harvest of the sea is used for food, for glue-making, and for manure. Porphyra (a genus occurring in New Zealand) is grown on twigs placed in suitable waters.

It may here be pointed out that the most economical use of seaweed as a fertilizer on New Zealand soil adjacent to the sea would be made by ploughing it in to the land without any previous treatment than perhaps a slight preliminary drying on the beach with the aid of the sun and wind. It readily decomposes in the soil, liberating its constituents. It is comparable in the fresh state with farmyard manure, but, unlike this, contains no weed-seeds, insect or fungus pests. The class of crops on which it might be expected to show the best results would be those on which stable manure is most profitably used. As it is essentially a potash, nitrogen, and humus fertilizer, and to a much less degree a phosphate fertilizer for phosphate-demanding crops, it should be used in conjunction with phosphatic manures. If it is desired to intensively cultivate sandy soils occurring near the coast, seaweed would in many cases prove an admirable manure, especially for such crops as potatoes.

Dr. Cockayne, F.R.S., has kindly supplied me with a list of seaweeds which occur in large quantities round the New Zealand coast, and which as time and opportunity afford I intend to inquire more closely into with regard to the relative abundance and possibly their content of valuable constituents. They are as follows: *D'Urvillaea utilis*, *Macrocystis pyrifera*, *Xiphophora (Fucodia) chondrophyllum*, *Landsburgia quercifolia*, *Hormosira Banksii*, *Carpophyllum phyllanthus*, *Carpophyllum Maschalocarpus*, *Lessonia variegata*, *Cystophora retroflexa* (and several other species), *Marginaria* sp.

I should welcome information concerning the localities where any of these may be largely obtained (by the ton), but as the analysis should be made on samples collected with extreme care, which can only be done by one conversant with the difficulties of sampling, samples for analysis are not asked for. Specimens for identification would, however, be welcomed, with any information sent in where the sender is not sure of the correct name.

BRACKEN, OR "FERN."

The well-known fern being such a pest in New Zealand, it is of interest to note that Professor Berry, F.I.C.,* of the West of Scotland Agricultural College, has found the ash to be surprisingly rich in potash, although apparently very variable in composition. He states that 10 acres of fully stocked bracken land is found to produce 1 ton of ash, which may contain as much as 20 per cent. of potash. In New Zealand, where fern may grow to a height of 10 ft. to 12 ft., it seems possible that the yield of ash per acre may be considerably larger, and on a rich potash soil, such as the pumice lands of the North Island, this fern might prove a more feasible source of potash than seaweed, while the removal of a pest would be an additional reason for work in this direction.

INSOLUBLE SILICATE ROCKS.

American workers† are experimenting with insoluble silicate rocks, such as feldspar, which contains up to 14 per cent. of potash, in an endeavour to extract the latter on a commercial scale. In one of the processes a by-product remains which may be suitable as a substitute for clay in the manufacture of Portland cement. Prianischnikoff,‡ in comparing feldspar and mica as a potassium manure in experiments with different plants, showed that mica is better as a source of potassium than orthoclase. Chatelan and Bieler§ showed that this was due to the greater solubility of mica (muscovite) in water, which dissolves at the rate of 0·48 part, while more finely ground feldspar (orthoclase) yielded only 0·2 part. The solubility of the potash of mica was increased by the addition of gypsum, peat, ammonium sulphate, quicklime, citric acid, and superphosphate, and by hydrochloric acid. Rye-grass was able to assimilate potash from mica which had previously been extracted with hydrochloric acid. The authors conclude that mica furnishes not only potash but magnesia and fluorine of importance in the nutrition of plants and animals. Blanck,‖ in sand cultures in which oats were manured with muscovite and biotite as sources of potash in addition to ammonium nitrate and the usual minerals, found that with kinds of mica they gave increased amounts of dry matter as compared with the yields without potassium. Biotite yielded a much greater amount of potassium than muscovite (common mica). The author concludes that both minerals are more suitable as sources of potassium

* *Fertilizers and Feeding-stuffs Press*, 11th March, 1916. † *Chemical World*, April, 1913, p. 119. ‡ Abstract in Journ. Chem. Soc., 1906. § Abstract in Expt. Station Record, 1910, p. 716. ‖ Abstract in Journ. Chem. Soc., 1912.

than potassium feldspar. This, of course, does not mean that more potassium can be got from mica than from feldspar, but only that the plant is able to get more.

SUMMARY.

From the foregoing facts and the information supplied in previous articles it is fair to conclude that only for special crops, such as potatoes, garden crops, mangels, and a few other potash-loving crops, are New Zealand soils immediately in need of potash-manuring, and it is with these crops and with reclaimed swamps deficient in potash that experiments might be instituted to determine whether the deficiency may be economically supplied by resources available in the Dominion. Researches having as their object the extraction of potash with a view to its export might well give place to others having a greater prospect of economic success.

SPRAY-TESTING AT ARATAKI.

EXPERIMENTS WITH PEACH-TREES.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

WORKING in conjunction with a consultative committee appointed by the Hawke's Bay Fruitgrowers' Association, the Horticulture Division of the Department decided to carry out annually at the Arataki Horticultural Station a series of experiments for the purpose of ascertaining the relative value of the various spraying-compounds in the control of diseases, both those at present in use and others which may from time to time be brought under the notice of the fruitgrower, as well as to ascertain the various strengths at which such compounds may be used at different periods without injury to the wood, buds, and foliage of the various classes of fruit-trees.

Prior to commencing operations last autumn a detailed scheme was prepared by the Division and adopted by the fruitgrowers' committee, covering a number of tests to be carried out on the peach area of the station during the autumn, winter, and early spring. The details of the scheme are shown in tabulated form on the opposite page.

SPRAY-TESTING ON PEACH-TREES, ARATAKI.

Thirty-four rows, seven trees per row: three on left and four on right of dividing-line.

Key.

M., May; J., July; A., August; B.S.S., bluestone solution; O., oil emulsion; L.S., lime-sulphur solution; L.W. Bordx., lime-water Bordeaux; L.S. powder, lime-sulphur powder.

1	M. B.S.S. 1–30.	B.S.S. 1–30.
	O. 1–20.	O. 1–17.
	J. Nothing.	Nothing.
	A. Nothing.	Bordeaux 8–5–40.
2	M. Nothing.	Nothing.
	J. B.S.S. 1–30.	B.S.S. 1–30.
	O. 1–20.	O. 1–30.
	A. Nothing.	L.S. 1–15.
3	M. B.S.S. 1–25.	B.S.S. 1–25.
	O. 1–20.	O. 1–17.
	J. Nothing.	Nothing.
	A. Nothing.	L.S. 1–17.
4	M. Nothing.	Nothing.
	J. B.S.S. 1–25.	B.S.S. 1–25.
	O. 1–20.	O. 1–17.
	A. Nothing.	Bordeaux 8–6–10.
5	M. B.S.S. 1–20.	B.S.S. 1–20.
	O. 1–20.	O. 1–17.
	J. Nothing.	Nothing.
	A. Nothing.	Bordeaux 8–6–40.
6	M. Nothing.	Nothing.
	J. B.S.S. 1–20.	B.S.S. 1–20.
	A. Nothing.	L.S. 1–20.
7	M. B.S.S. 1–15.	B.S.S. 1–15.
	O. 1–20.	O. 1–17.
	J. Nothing.	Nothing.
	A. Nothing.	L.S. 1–20.
8	M. Nothing.	Nothing.
	J. B.S.S. 1–15.	B.S.S. 1–15.
	A. Nothing.	Bordeaux 8–6–40.
9	M. Bordeaux 8–6–40.	Bordeaux 8–6–40.
	J. O. 1–17.	O. 1–17.
	A. Bordeaux 8–6–40.	Bordeaux 8–6–40.
10	M. Bordeaux 8–6–40.	Bordeaux 8–6–40.
	J. O. 1–15.	O. 1–15.
	A. L.S. 1–15.	L.S. 1–15.
11	M. L.S. 1–12.	L.S. 1–12.
	J. Nothing.	O. 1–20.
	A. L.S. 1–20.	Bordeaux 8–6–40.
12	M. L.S. 1–15.	L.S. 1–15.
	J. Nothing.	O. 1–17.
	A. L.S. 1–15.	Bordeaux 8–6–40.
13	M. L.S. 1–20.	L.S. 1–20.
	J. Nothing.	O. 1–15.
	A. L.S. 1–12.	Bordeaux 8–6–40.
14	M. Nothing.	Nothing.
	J. Nothing.	Nothing.
	A. Bordeaux 8–6–40, followed a week later with O. 1–20.	
15	M. Nothing.	Nothing.
	J. Nothing.	Nothing.
	A. Bordeaux 8–6–40, followed a week later with O. 1–17.	
16	M. Nothing.	Nothing.
	J. Nothing.	Nothing.
	A. B.S.S. 1–20.	B.S.S. 1–20.
	O. 1–17.	O. 1–17.
17	M. Nothing.	Nothing.
	J. Nothing.	Nothing.
	A. B.S.S. 1–25.	B.S.S. 1–25.
	O. 1–20.	O. 1–20.
18	M. Nothing.	Nothing.
	J. Nothing.	Nothing.
	A. L.S. 1–15.	L.S. 1–15.
	O. 1–20.	O. 1–20.
19	M. Nothing.	Nothing.
	J. Nothing.	Nothing.
	A. L.S. 1–20.	L.S. 1–20.
	O. 1–17.	O. 1–17.
20	M. L.W. Bordx.	L.W. Bordx.
	Equivalent to 8–6–40 Bordeaux.	
	J. O. 1–17.	O. 1–17.
	A. L.W. Bordx.	L.W. Bordx.
21	M. L.W. Bordx.	L.W. Bordx.
	J. O. 1–20.	O. 1–20.
	A. L.W. Bordx.	L.W. Bordx.
22	M. Bordeaux 8–6–40.	Bordeaux 8–6–40.
	J. O. 1–20.	O. 1–20.
	A. Bordeaux 8–6–40.	Bordeaux 8–6–40.
23	M. Soda Bordx.	Soda Bordx.
	Equivalent to 8–6–40 Bordeaux.	
	J. O. 1–25.	O. 1–25.
	A. Soda Bordx.	Soda Bordx.
24	M. Soda Bordx.	Soda Bordx.
	J. O. 1–25.	O. 1–25.
	A. Soda Bordx.	Soda Bordx.
25	M. L.S. powder.	L.S. powder.
	J. Nothing.	Nothing.
	A. L.S. powder.	L.S. powder.
26	M. L.S. powder.	L.S. powder.
	J. Nothing.	Nothing.
	A. L.S. powder.	L.S. powder.
27	M.	
	J. O. 1–17.	O. 1–17.
	A. Cooper's Bordx.	Cooper's Bordx.
28	M.	
	J. O. 1–17.	O. 1–17.
	A. Cooper's Bordx.	Cooper's Bordx.
29	M.	
	J. O. 1–20.	O. 1–20.
	A. Cooper's Bordx.	Cooper's Bordx.
30	M.	
	J. O. 1–20.	O. 1–20.
	A. Bordeaux 8–6–40.	Bordeaux 8–6–40.
31	M.	
	J. O. 1–20.	O. 1–20.
	A. Lawes' Anti-blight.	
32	M.	
	J. O. 1–25.	O. 1–25.
	A. Lawes' Anti-blight.	
33	M.	
	J. O. 1–25.	O. 1–25.
	A. Lawes' Anti-blight.	
34	M.	
	J. O. 1–25.	O. 1–25.
	A. Soluble sulphur.	

PROGRESS REPORT.

The work connected with the testing was carried out by the Manager of the Station, Mr. W. H. Taylor, assisted by the local Orchard Instructor, Mr. G. Esam, who have furnished a progress report as follows :—

The spraying experiments carried out on the peach area at the Arataki Horticultural Station during last autumn, winter, and early spring included most of the leading fungicides—viz., Bordeaux mixture, lime-water Bordeaux, soda Bordeaux, Cooper's Bordeaux, Lawes' Anti-blight, bluestone solution, lime-sulphur solution, and soluble sulphur. The result is also given of the Vallo Bordeaux paste, which was not provided for in the scheme. Thirty rows out of the thirty-four were also sprayed with oil at varying strengths.

Bluestone solution was used from 1 lb. to 15 gallons to 1 lb. to 30 gallons. In most tests with this fungicide, oil was used a day or two afterwards, so as to bind the bluestone to the tree. This method is considered by many authorities to increase the fungicidal properties of pure bluestone solution.

Lime-sulphur was used from 1 to 12 to 1 to 20, Bordeaux mixture 8–6–40, Cooper's Bordeaux 6 lb. to 40 gallons, Lawes' Anti-blight 10 lb. to 40 gallons.

The first part of this report will deal with the effect and safety of the mixtures on the trees. This is most valuable information for growers, as it indicates certain sprays which injured or checked growth and others which proved safe to use. The notes on the effect of the sprays were taken on the 5th October, and can be summarized as follows :—

Oil, 1–15 to 1–17, is safe to use the third week in July.

Oil, 1–20, applied just as the buds were showing pink, checked growth, but not seriously.

Oil, 1 in 25, applied when trees in bloom checked growth seriously and prevented setting of the fruit. This spray was applied at the request of the Fruitgrowers' Association. The request reached Mr. Taylor too late to apply the spray at the swelling of the buds.

Further tests are necessary to determine whether oil, 1–17, is safe to use in the autumn—say, first or second week in May.

Bluestone solution, 1 lb. to 30 gallons, followed three days later by oil, 1–20, applied the second week in May, checked growth. At this season (autumn) injury increased as the strength of bluestone was increased. Whether it was the bluestone, oil, or both combined, which caused the injury cannot be determined, as bluestone alone was not used at this period.

Bluestone, 1–25, followed three days later with oil, 1–17, applied the third week in July, is safe to use.

Bluestone, 1–15, by itself is safe to use the third week in July.

Bluestone, 1–20, followed two days later with oil, 1–17, applied third week in August, checked growth, but not seriously.

Lime-sulphur, 1–15, was applied in seven varieties when trees in bloom. It did not hurt the trees, and apparently did not interfere with the setting of the fruit. This strength proved safe when applied in autumn, at swelling of the buds, or both seasons combined.

Lime-sulphur, 1–12, checked growth somewhat, and in some varieties injured buds when applied in autumn or at the bursting of the buds.

Lime-sulphur powder, equivalent to lime-sulphur solution 1–15, was just as safe as lime-sulphur solution at that strength.

Bordeaux, 8–6–40, proved quite safe in early autumn, at swelling of the buds, or both seasons combined. Same applies to soda Bordeaux, equivalent to 8–6–40 ordinary Bordeaux.

Lime-water Bordeaux, equivalent to 8–6–40 ordinary Bordeaux, when applied twice, once in autumn and repeated at the swelling of the buds, checked growth. It could not be determined from the result whether one spraying only would have the same result.

Cooper's Bordeaux, 6 lb. to 40 gallons; Lawes' Anti-blight, 10 lb. to 40 gallons; and Vallo paste, 8 lb. to 40 gallons, proved quite safe to apply at the swelling of the buds.

Control of Peach Leaf-curl.

Leaf-curl has been very prevalent throughout the district in spite of spraying. The weather was showery during the spring and the atmosphere moist, conditions which are favourable to the development of curl. It has been a particularly good season for testing the fungicidal properties of spraying-compounds, which have been taxed to their utmost limit to stop curl-development. We have endeavoured to put the results of the tests as regards leaf-curl in as concise a form as possible, as follows:—

Bordeaux mixture at 8–6–40, used in twelve tests—four times in the spring, following pure bluestone solution applied in May or July; three times in the spring, following lime-sulphur application in May; once in May, with lime-sulphur following in the spring; twice a double application, one in May the other in spring; twice spring application only. On the whole all the plots were practically free from curl. There was no noticeable advantage with a double application, one in the autumn and again in the spring, over a single application in the spring. This possibly explains why there was no noticeable difference between Bordeaux following pure bluestone or lime-sulphur and Bordeaux following Bordeaux. As there was a little curl showing on some of the more subject varieties, it indicates that Bordeaux at a strength of 8–6–40 is possibly just slightly below the minimum strength which will give the best results in a season such as this one.

Soda Bordeaux, equivalent to 8–6–40 ordinary Bordeaux, was used in two tests covering fourteen trees. It was applied twice, once in May and again in the spring. Result was equal to that of Bordeaux applied at the same seasons.

Lime-water Bordeaux, equivalent to 8–6–40 ordinary Bordeaux, covered a similar test to that of soda Bordeaux. Result was about equal to ordinary Bordeaux, but, as previously noted, this mixture checked growth. This must be taken into consideration.

Cooper's Bordeaux powder, 6 lb. to 40 gallons: Used in three tests covering twenty-one trees; applied in the spring only. Poor result; curl very bad. Mr. Taylor, after procuring a fresh supply of this powder, is satisfied that the spray used in this test was from old stock. He therefore desires to withdraw the test without any prejudice, considering it by no means a fair trial.

Vallo Bordeaux paste, 1 lb. to 5 gallons: About fifty trees were sprayed; applied in spring only. Very poor result: curl very bad.

Lawes' Anti-blight, 10 lb. to 40 gallons: Used in three tests covering twenty-one trees; applied in the spring only. Result very fair with nineteen out of twenty-one trees. A promising spray and worthy of further trials.

Bluestone solution used in ten tests—four tests applied in May at from 1 lb. to 15 to 30 gallons, oil being applied two or three days later. Control of curl only fair, but injury to trees more or less severe. Whether bluestone alone applied at this period would give the same result cannot be determined from the tests. Two sprayings were applied in July, 1 lb. to 25 and 30 gallons, followed two days later with oil. Curl bad; very poor result.

Two tests applied in July with oil following at 1 lb. to 15 and 20 gallons. Infected by curl, but not as badly as in the two former tests.

Two tests applied in the spring—seven trees, 1 lb. to 20 gallons; seven trees, 1 lb. to 25 gallons, followed two days later with oil. Curl bad compared with Bordeaux.

Lime-sulphur solution was used in many tests and at different seasons. Applied 1 to 20 gallons in May, and repeated in spring at a stronger strength (1–12), did not compare favourably with Bordeaux, 8–6–40, applied in the spring only. This was a fair test, as it covered the same varieties.

Lime-sulphur, 1–15, applied on fourteen trees, when in bloom and part foliage, and also when in part bloom only, failed to control curl. As a matter of fact, curl was very bad. Lime-sulphur was also used at weaker strengths, but right through the whole of the tests it did not compare at all favourably with Bordeaux, 8–6–40.

Lime-sulphur powder, equivalent lime-sulphur solution 1–15 was tested on fourteen trees. It was applied twice, once in May and again in the spring. Result equal to Bordeaux 8–6–40, and certainly worthy of further trials.

Soluble sulphur, applied in the spring and tested on seven trees: Curl very bad, particularly in contrast to Lawes' Anti-blight applied on the same varieties.

REMARKS.

The feature of the tests so far has been the consistency of Bordeaux mixture in its results. It must be understood that the above is an interim report only. The effect of the various sprays on ripe-rot and possibly shot-hole fungus and rust are yet to be noted. The results of the insecticides have also to be recorded. At the conclusion of all the tests the merits of one spray against another can be more definitely weighed.

Further spray-testing is being carried out at the Station with pip-fruits, a report on which will be published after the end of the season.

THE MEADOW-FOXTAIL MIDGE.

A. H. COCKAYNE, Biologist.

DURING the past decade one of the outstanding features in the laying-down of permanent pasture on certain types of first-class-quality land in the North Island has been the increased amounts of meadow-foxtail seed included in the sowings. Each year shows that in the wetter districts of the North Island the range of adaptability of foxtail is far greater than was formerly supposed. At one time sown only on reclaimed swamp land of the highest quality — and certainly the best pastures devoted to this grass are found on such country—experience has shown that it thrives excellently on many classes of soils, provided they are supplied with an abundant summer rainfall. Unless of a naturally wet character, lands subject to summer droughts are quite unsuitable for foxtail, and this led to the erroneous assumption that only on swamp lands was its employment profitable. Foxtail, to the extent of 1 lb. or 2 lb. per acre, is now regularly included in many sowings on bush-burns in the North Island; and it is mainly this extension of its use that has led to the very notable increase in the demand for the seed. In the South Island foxtail is rarely used in any quantity except on swamp land, but there is no doubt that certain portions of Southland, and more particularly the West Coast, are admirably adapted for its growth, and that in those regions it should finally occupy an important position in permanent pasture mixtures.

DISABILITIES OF FOXTAIL-SEED.

The two great objections to meadow-foxtail seed are its high price and poor germination. This latter defect renders its high price a more serious matter than if the seed were of generally high vitality, as it greatly increases the quantity of seed necessary to sow. The lowness of germination is generally due to the fact that all lines, although well cleaned from the point of view of extraneous seeds, contain a large percentage of empty husks and immature kernels. Foxtail, unlike most grasses usually sown, does not produce the majority of its seed-heads more or less simultaneously, and unless the greatest care is taken in the management of seed-

MEADOW-FOXTAIL MIDGE: IMAGO STAGE.
On right, male; on left, female. Magnification, 10 diameters.

FOXTAIL-HEADS.
Showing stage when most liable to attack.
[*Photos by E. B. Levy.*

paddocks heads in all stages of ripeness are present when the crop is harvested. The amount of empty husks and immature kernels could, of course, be reduced by drastic blowing in the process of cleaning, but the loss of weight is so great when thoroughly carried out that the price that would be demanded would deter farmers from purchasing, although the actual price of the pure living seed would be no dearer than is paid at present for poorly blown lines.

Another cause of low germination, especially in locally produced seed, is due to infestation by a minute fly, the meadow-foxtail midge, that now threatens to inhibit the production of foxtail-seed in New Zealand. The increased demand during recent years for foxtail-seed, and the very profitable returns obtained, led to the production of considerable amounts of local seed. Until a couple of seasons ago, when the foxtail-midge commenced to cause serious damage, it was confidently expected that before long sufficient seed of good quality would be produced to fulfil all local requirement and also provide a surplus for export.

ORIGIN OF FOXTAIL-SEED SUPPLY.

Until quite recently about one-half of the foxtail-seed used in New Zealand was locally grown, the remainder being of European origin. The main foreign sources of supply are Scandinavia, Russia, Finland, and Holland. Since the war began our main supplies have come from Russia via Scandinavia, and transhipped from Great Britain. Finnish seed is of better quality than that grown in the more southern parts of Europe, the short northern summer being favourable to the uniform development of the seed-heads.

New Zealand seed is produced in two localities — namely, in the Manawatu and Tauranga districts. Before the advent of the foxtail-midge about 18 tons were annually produced in the neighbourhood of Foxton and Shannon, and about one-third of that quantity in the vicinity of Tauranga. Many years ago a small amount of seed was harvested near Christchurch, but during the past ten years Manawatu and Tauranga have been the sole sources of local supply. New-Zealand-grown seed when free from midge is generally more than equal to the best Russian, that produced in the Manawatu being, if anything, superior from a germination point of view to Tauranga-grown lines. Were it not for the midge the growing of foxtail-seed would have become quite an important phase of local grass-seed-raising, but unless the insect can be satisfactorily controlled the utilization of this grass for seed-production will have to be abandoned.

DISTRIBUTION OF FOXTAIL-MIDGE.

The foxtail-midge is a small fly, 1·2 to 1·3 millimeters long, closely related to the Hessian fly (*Mayetiola destructor* Say.) and the wheat-midge (*Contarinia tritici* Kirby). Both these pests are present to a limited extent in New Zealand wheat-fields, but, being kept in subjection by natural enemies, rarely cause sufficient damage to be ranked as of any moment. The foxtail-midge was originally thought to be a variety only of the wheat-midge, but Reuter in 1900 showed that the fly belonged to the genus Oligotropus, and described it under the name of *Oligotropus alopecuri*. It is probably distributed wherever meadow-foxtail is cultivated, but was formerly thought to be confined to Scandinavia and Great Britain. The larvæ of the insect were first noticed in locally grown foxtail-seed some six years ago, but not until 1914 was it present in sufficient numbers for anticipation that any serious damage would be caused. European samples of foxtail frequently contain a small percentage infected with the midge, but not seriously enough to ruin the lines for sowing purposes. In 1915, however, the Manawatu crop was virtually ruined, in many cases 70 per cent. of the seed being destroyed, rendering the output quite unsaleable. In 1916 infection was even worse, and no seed was harvested in the Manawatu district. Again, this season the midge is so prevalent that it is unlikely that any crops will be cut for seed except in the Tauranga district. Last season infection in that district was about the same as that occurring in 1914 in the Manawatu district.

The condition of this season's Tauranga crop is at present not known, and if the seed remains fairly free from infection it is likely to be due to the presence of natural enemies, probably identical with those that hold the insect in check in Europe. If, however, these natural enemies are not established there it is almost certain, judging from Manawatu experience, that foxtail-seed production at Tauranga will be impossible until such time as practical methods for the control of the midge are carried out. So far as the Manawatu is concerned, no parasitized material has been found, and the extraordinary development of the insect during the past three years indicates that no natural checks are at work.

LIFE-HISTORY OF FOXTAIL-MIDGE.

The foxtail-midge appears on the wing in New Zealand about the beginning of September. This season the first specimens were collected on the 22nd of that month, but the presence of nearly fully developed larvæ in foxtail-heads at that date showed that they

must have been on the wing for some time. The female midge lays a large number of eggs, generally in clusters of from three to nine. These eggs are long and pointed, and are generally deposited on the outer surface of the flowering-glumes, often near their base. The seed-heads are generally infected when quite young, the favourite period being just after they have burst through the sheath-leaf. Egg-laying also occurs on older heads, even up to the stage when the stamens protrude from the glumes. The eggs when first laid are white, but with the development of the larvæ become orange-red. The legless bright-red larvæ hatch out in from four to six days, and wriggling out of the ruptured shells

FIG. A.

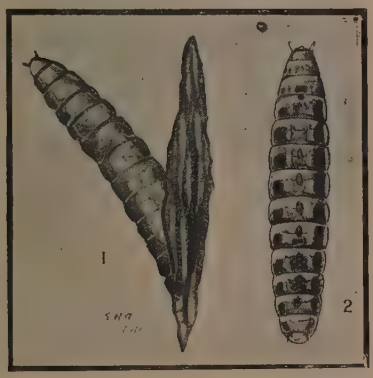


FIG. B.

Fig. A. Foxtail-midge in Pupa Stage. Left, ventral side; right, dorsal side.

Fig. B. Larvæ of Foxtail-midge. 1. Larva breaking through Egg-case. 2. Fully-grown Larva. Magnification, 12 diameters.

crawl to the top of the glumes. They then descend on the inside, feeding for some time on the young stamens, and by sucking out the juices of the soft kernel stop its development. Several larvæ may be occasionally found in a single seed, but generally one only is found. The larvæ finally pupate where normally the kernel is developed, and with the emergence of the fly the life-cycle is completed.

It is evident that in New Zealand the foxtail-midge is several-brooded. Last season larvæ collected in September emerged as flies during the middle of November. Whether or not the broods are quite distinct, or whether they overlap, is not known,

but it is probable that overlapping occurs, and that flies are on the wing most of the spring and early summer. The larvæ in foxtail-seed harvested in the last week of December remain in the larval stage for some months, and finally pupate in the winter, emerging as flies about the end of September, provided the seed is moistened, but otherwise remain dormant until the "seed" is sown. On a casual inspection an infected foxtail seed-head can easily be thought to be unaffected, but if the "seeds" are stripped off every infected "seed" will show a red coloration at its base. When the glumes are opened out, instead of a kernel falling out the legless larva or pupa can be distinctly seen, even with the naked eye.

CLUSTER OF FOXTAIL-MIDGE EGGS AT BASE OF SEED.
Magnification, 12 diameters.

It is thus clear that any flower infected with the larvæ will fail to mature a kernel. At times only a few flowers in a head may be infected, but generally nearly every one is attacked, and not a single living seed is produced by the head in question. In Scandinavia the average infection is less than 8 per cent., but in many New Zealand lines during the past two seasons 70 per cent. of infection was not uncommon.

SUGGESTIONS FOR CONTROL.

Until such time as the local life-history of the foxtail-midge is carefully worked out any suggestions as to control must only be of a tentative nature. When the pest first became serious a trial was made of mowing fields late in October, with the idea that the later-developed heads might escape infestation, but this plan was not a success. If, however, the broods are separated from one another by a reasonable length of time, retarding the development of seed-heads till late in the year should prove effective. During this year on a badly infested field near Foxton extremely heavy stocking with cattle from August to the end of October was tried. The season, however, was so favourable for grass-growth that premature seeding could not be kept down, and in every case the seed-heads were so seriously infected that shutting up for seed had to be abandoned. Another difficulty that has been experienced is with regard to the seeding of foxtail in places

inaccessible to stock adjoining the seed-paddocks. Unless a very large expenditure is incurred this seeding cannot be stopped, and such places act as sources of infection of the adjoining fields.

Control by means of natural enemies offers the most hopeful field for investigation, and this phase of the matter is being studied. In Europe natural-enemy control is so efficient that no special methods of dealing with the pest are carried out. So long as the insect remains as prevalent as it is in the Manawatu it would be useless to attempt seed-production there, but it is quite possible that certain special conditions that are not usually present account for the great damage caused during the past two years, and that matters may right themselves naturally. I am afraid, however, that such will not be the case, and that the tremendous increase of the insect is due to the absence of natural-enemy checks. In this connection the position at Tauranga requires careful investigation, as in that district, so far, the loss has not been greater than in European foxtail-seed fields.

PROVISION OF FOXTAIL-SEED.

So far as the farmer is concerned, he should exercise the greatest care in the purchase of foxtail-seed. The best procedure for him to adopt is to demand from seed-merchants this Department's certificate of germination before purchasing any line. Provided the germination is satisfactory, and anything over 40 per cent. may be considered good for foxtail, it does not matter whether foxtail-midge is present or not so far as the laying-down of pasture is concerned. However, in most cases of locally produced foxtail the presence of midge is synonymous with extremely low germination, and such lines should be rejected. If the farmer will not go to the trouble of demanding a germination certificate before purchasing, he should at least carefully examine the seed and refuse those lines that show a large percentage of "seeds" possessing a red coloration where normally the kernel is developed.

The damage caused by foxtail-midge is confined entirely to crops intended for seed, and the presence of the insect is of no moment from a grazing point of view. Thus the prevalence or otherwise of the midge will have no influence on the use of foxtail-seed in grass mixtures intended for grazing or haymaking purposes. Of course, the more or less complete elimination of locally grown seed will considerably harden up prices; in fact, prices are likely to become so high that farmers will be inclined to omit foxtail from their mixtures. Apart from the difficulty

and uncertainty of securing imported seed—nearly all lines are at present being shipped from Scandinavian ports and have to cross the North Sea—freight is almost prohibitive owing to the bulkiness and light bushel-weight of the seed.

On certain types of ploughable land where foxtail ought to be included in any permanent mixture it might be a good policy to lay down a temporary mixture containing a large proportion of Italian rye and wait for two or three years before sowing a permanent mixture, by which time prices most likely will have dropped to their normal level. On bush-burn country suitable to the development of foxtail, where a surface-sown seeding is the only one possible for many years, farmers are advised not to omit a reasonable amount of foxtail—say, from 1 lb. to 2 lb. per acre—even if the price may appear exorbitantly high. On suitable ground of this description it will certainly be profitable to sow foxtail at 3s. per pound, and even at that apparently extraordinary price it will be cheaper, in comparison with normal prices, than is cocksfoot at from 1s. 3d. to 1s. 6d. per pound.

MILK-FEVER (PARTURIENT APOPLEXY).

A. R. YOUNG, M.R.C.V.S., Veterinary Supervisor.

THE disease of milk-fever affecting dairy cows continues to be the subject of many inquiries forwarded to the Department. Although most dairy-farmers are now able to recognize a case when it occurs (especially if they have seen one previously) and know the most reliable treatment to adopt, there appear to be a considerable number who are at times perplexed. The matter is given increased importance by the greatly enhanced value of cows, hence the desire for further information, which in itself is a sign of progress. It cannot be too firmly impressed upon stockowners that a very considerable amount of the annual loss of stock in this country is due to carelessness in management. This could be avoided, and with a wider knowledge of the needs of animals better results could be obtained.

Milk-fever is brought about by the act of calving and abnormal conditions following. The former being a healthy action requires no comment; it is in the abnormal conditions following calving that is found the field for investigation. Taking as a basis the opinion of British and Continental authorities of the present day—namely,

that milk-fever is brought about by a poisonous secretion which takes place in the udder and which is at once absorbed into the blood—our attention is limited for the present to that organ. The first idea to strike the observer would naturally be why all cows are not subject to this disease, seeing that all udders are the same in structure and their functions alike. But we know that all cows do not suffer from milk-fever, therefore there must be some influence brought to bear upon the udder rendering it susceptible to take on the unhealthy action producing the toxin. This gives a clear starting-point. The trouble is not the fault of the udder, but of some influence acting upon it during the early stages of lactation.

It is known that the first milk possesses laxative and somewhat irritant properties necessary to expel from the calf the fæces which have accumulated in its intestines while unborn, and it is at this transitionary stage of the milk that the trouble begins. The field, therefore, narrows itself down to influences acting upon the udder at or shortly after calving. Some of these influences are well known, others still are rather obscure. Among the recognized predisposing causes the age of the animal plays an important part, the disease rarely affecting animals which have not reached maturity. Then follows the influence of strains, some milking-strains being more susceptible than others; the improved cow—the heavy milker, the good doer—is the most likely to suffer, and high-conditioned animals are all predisposed to milk-fever. Looking at these factors combined, it is at once apparent that the problem has been further reduced, as each represents one general condition—that of *excess*. We can go further and include secondary influences, such as sudden changes in the weather, electrical disturbances, flushes of feed, and the answer is the same. This being the case, the conditions over which are held the controlling-power in prevention may be considered.

PREVENTION.

The age of the animal may be dismissed, except as the interesting stage at which the cow has reached maturity, thereby placing her in a more favourable state to become the victim of excess. "Condition" is a much-abused term when indiscriminately applied to animals. "In good condition" should mean in good condition for the purposes for which the animal is required. For example, a bullock ready for profitable slaughter may be spoken of as in good condition, but it is absurd to apply the same term to a horse in the show-ring which, although bred for the purposes of

hard work, is often seen so fat as to be hardly able to walk. So it often is with a cow just coming on to calve—good to look upon, fat, belly gorged, and blood in a plethoric state. The animal would be referred to by the inexperienced as in grand condition, without considering that within a short time she will be called upon to undergo a trying ordeal requiring the most healthy co-operation of all her organs, every one of which must be a worker free from superfluous fat yet not so far reduced as to interfere with the nutrition required for healthy work. The cow of to-day (in New Zealand at least) lives under more artificial conditions than did her breed ten years back. Man is still adopting every conceivable method to increase her supply of milk and butter-fat, so much so that there is a danger of the balance set by nature being upset. In order to guard against this the importance of a good constitution must always be kept in view. The udder is but the till, constitution is the business concern which fills it.

Even given a good constitution there still remains much for the dairyman to attend to. He has brought the cow under abnormal conditions and must protect her in keeping with these changes. It would be good practice, therefore, to make a special inspection of all cows at from three weeks to one month from calving, when, if any appear too fat, they should be put upon shorter rations and given plenty of walking exercise, compulsory if necessary. On the other hand, should the animal's appearance suggest any signs of weakness she should have special feeding. After calving, no matter whether she has cleansed or not, every cow should be washed out within a few hours with water which has been boiled and allowed to cool to bloodheat. No disinfectant need be used at this stage, the object of the washing being to remove from the womb all fluid, which if left rapidly undergoes change detrimental to the animal's health, and which is the cause of much trouble in cows apart from milk-fever.

SYMPTOMS.

These are characteristic of the disease: The animal appears to be intoxicated, which indeed she is with toxin from the udder, and maybe from the womb. The legs are spread widely apart, the head lowered, eyes bloodshot with their pupils dilated, blood-vessels of head and neck gorged, and ears and horns hot. If made to move, the animal does so with difficulty and without any apparent desire to move in any one direction. In the early stages the temperature and pulse are increased, and in many cases the animal is somewhat "blown." Usually developments are rapid and she falls down; when down, for a short time the head is

lashed about, with the legs twitching, but gradually an unconscious condition sets in, and if no relief is forthcoming death supervenes.

TREATMENT.

To the dairyman this is the most important matter, because the treatment to be adopted does no harm, even although the trouble may not be milk-fever. It is not necessary to go into details of the older methods of treatment, the only reliable cure being air-injection of the udder. This in itself is fortunately very simple, although unfortunate results may follow careless application. The action of air treatment upon the disease can be studied in veterinary text-books. The only action the dairyman is directly concerned with is that of the animal regaining her feet.

A complete outfit for the air-injection cure should be in the hands of every dairyman, and can be secured from almost any chemist at prices ranging from 10s. 6d. to £3 3s. It is short-sighted policy to get an outfit only when required. The disease is sudden in its development, and the remedy must be applied at once; the delay of an hour or two often means the difference between a live cow and a dead one. In buying a milk-fever syringe always stipulate that all its parts are capable of being boiled without destruction, it being absolutely necessary to boil the instrument after using, and, if disused for some time, before using. When cotton-wool is used to pass the air through it should be destroyed when the injection is finished, as there is often a drawback of some milk from the udder, which gets caught in the wool and rapidly decomposes.

As regards the method of applying the treatment there is only one matter on which authorities differ. American writers advise that no milk be drawn from the udder before injection, claiming the best results from this method; whereas others hold that the animal be milked first. Presuming that there is a poisonous secretion in the udder, the latter method would appeal more to us; but facts cannot honestly be overcome and are always worth considering. It would, in fact, appear doubtful which is the better method, but as both are good the matter is not essential to success.

Before applying the air treatment the udder and teats should be carefully washed and dried; then take the lower end of the teat-tube between the forefinger and thumb, feel for the opening into the teat, and slowly push the tube up, moving the finger and thumb backwards and forwards, rolling it, so to speak, without turning it right round. The tube should never be pushed up direct, as it is thereby likely to injure the sensitive lining membrane

of the teat. The quarter is next filled with air until it is distended to its utmost capacity, and this is aided by massage. After withdrawing the tube do not tie the end of the teat: this is a dangerous procedure, and often damages the teat, and causes the animal great pain when the tie is removed, as the circulation of the blood to that part has been interfered with. Moreover, tying is not necessary except for very free milkers, in which cases a broad band should be used. The other quarters are now treated in the same way, and the whole process should be repeated in two hours' time if the animal has not responded to the first treatment.

Internal administration of drugs after the cow is down is to be condemned, the risk of choking being too great. The only safe way is by hypodermic injection, and by this means Eserine and Pilocarpine has been found beneficial. If the animal is severely flatulent the gases should be removed, either by using the probang, or trocar and canula, as any regurgitation when a comatose state exists is almost sure to cause fatal results through food gaining access to the windpipe. As a rule the bladder is paralysed, and the urine either trickles freely away or becomes retained to a dangerous degree. In the latter case it must be removed by mechanical means. This operation is a simple one after having been once observed, but where experience is lacking the services of a veterinarian had better be called in.

After the air-injection is finished the animal should be made as comfortable as possible, placing her upon her brisket, with head uphill, and packing her up in this position with straw or other suitable material, head and neck about 1½ ft. from the ground. A cow with milk-fever should always be treated as one would a person taken unconscious from water — *i.e.*, continue treating until you are sure that she is dead. After recovery the animal should have careful nursing for a few days; give laxative food, and keep her quiet and comfortable.

The principal points to be kept in mind when a case occurs are prompt and energetic action and absolute cleanliness, the latter because the risk of inoculating the teat with another disease, such as contagious mammitis, is always present. Finally, always have on hand a proper outfit ready for use.

Contagious Mammitis.—The article on this subject by Dr. Reakes, Director of the Live-stock Division, published in the *Journal* for January, 1914, has been reprinted as a bulletin. Copies may be obtained free by application to the Department in Wellington, or from any Stock Inspector or District Agent. The bulletin is being widely circulated in the dairying districts.

THE LOCUST-BEAN.

SOME interest is being taken in the Dominion at the present time in the locust or Algaroba bean, which is the product of the carob-tree, and the following notes may be of assistance to prospective growers.

The tree is dioecious, from 20 ft. to 30 ft. in height when mature, with pinnate evergreen leaves and flowers in red racemes. It is a native of the countries bordering the Mediterranean, and requires warm summers and mild winters, with a mean temperature of not less than 64°. In southern Italy it does well on the hills overlooking the sea, and prefers stony ground with a calcareous subsoil.

Before planting, the seed should be soaked in water for three days, the water being changed every day. When the beans begin to swell they are planted and lightly covered with soil. If planted in nurseries, put the seeds 8 in. apart. In three years the trees should be shield-grafted with a dormant bud at the end of the summer. If the tree is a male, each branch must be budded from a female tree, reserving one ungrafted male branch to ensure fertilization in after-years. If the tree is female, one branch must be grafted with a male bud for the same purpose. Care must be taken in watching the male branch to ensure that it is really male, for on this depends the fertility of the tree.

In the case of nursery plants they may be transplanted the year after grafting — an operation requiring great care and necessitating watering during the following summer. In the south of France the trees are planted 50 ft. apart, and come into bearing at about seven or eight years of age.

The tree flowers in autumn, and the crop is harvested the following autumn, when the pods fall of their own accord. The pods have to be specially dried, and must not be heaped together until they have lost all their moisture, or they would ferment. An average crop is said to be 2 cwt. per tree.

Locust-beans are not often used alone, as their value is due rather to their sweet taste and pleasant aroma, giving a relish to other feeding-stuffs. At the same time they can be looked upon as a fattening-food for cattle and sheep, since the sugar-content is slightly over 50 per cent. In countries where artificial feeding is practised locust-bean is a favourite ingredient in compound cakes and in mixtures sold as lamb-food.—*J. Beverley, Assistant Plant-breeder, Moumahaki Experimental Farm.*

ORCHARD COVER-CROPS FOR THE MOUTERE HILLS.

WM. C. HYDE, Orchard Instructor, Nelson.

It is generally recognized that most soils are greatly benefited by the growing and ploughing-in of leguminous cover-crops. This practice is of special importance in the raising of an orchard, where strong healthy wood-growth is needed for the formation and the building-up of the young trees.

In the older-settled localities, where the land has been under cultivation for some time and its characteristics are therefore well understood, the successful raising of cover-crops should present few difficulties, although there may be some considerable diversity of opinion as to which is the most satisfactory crop to grow; but the position may be entirely different when altogether new areas of land are brought into cultivation.

An instance of this is to be found in the comparatively large areas of land recently planted with fruit-trees on the Moutere Hills, in the Nelson District. Although it has been clearly demonstrated that this land when properly treated will grow fruit-trees well, there is still something lacking in the soil in respect to the production of ordinary vegetation. This peculiarity, in many cases, renders the raising of a satisfactory cover-crop somewhat difficult, and, although such crops have been successfully grown, there still appears a good deal to be learned both as to the best means of treating the soil and the most suitable class of crop to grow.

Besides the improvement of the mechanical condition of the soil by the addition of humus, there is another important consideration in the sowing of cover-crops which applies particularly to hilly country comprising soil more or less light and free. Under such conditions the soil when cultivated is apt to scour badly from heavy rains during autumn and winter. This condition may be reduced to a minimum by adopting the system of sowing the land with a cover-crop in the autumn and turning it under in the spring.

With the idea of assisting the fruitgrowers of the Moutere district in satisfactorily overcoming some of the previously mentioned difficulties in the raising of cover-crops, the Horticulture Division of

the Department last season approached Mr. G. Stratford, formerly an officer of the Division, and now orchard supervisor for the Moutere Amalgamated Fruit Lands (Limited), with a view to establishing a series of manurial and cover-crop experiments. Mr. Stratford heartily co-operated in the scheme, undertaking to provide the land and labour required and, together with the writer, to supervise the work, the Department providing the working plan, seed, and manure. An orchard area on the Mahana Estate was selected for the tests. The work was commenced late in the month of March last and completed in the early spring, when the crops were ploughed in.

THE TESTS.

The scheme of the tests is shown in the following plan:—

	1. Blood & Bone, Basic Slag, Muriate of Pot. Rate, 1 cwt. each per acre. Cost, £2 2s. p.a.	2. Blood & Bone, Basic Slag. Rate, 1½ cwt. each per acre. Cost, £1 2s. 6d. p.a.	3. Blood & Bone, Superphos. Muriate of Pot. Rate, 1 cwt. each per acre. Cost, £2 2s. p.a.	4. Blood & Bone, Superphos. Rate, 1½ cwt. each per acre. Cost, £1 9s. 3d. p.a.	5. Blood & Bone. Rate, 3 cwt. per acre. Cost, £1 16s. p.a.	6. Lime only. Rate, 1 ton per acre. Cost, £1 17s. 6d. p.a.	7. Untreated. —
Crimson Clover, 16 lb. per acre. Cost, 13s. 4d. p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *
Common Vetch, 100 lb. per acre. Cost, £1 7s. 6d. p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *
White Lupin, 120 lb. per acre. Cost, £1 17s. 6d. p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *
Yellow Lupin, 120 lb. per acre. Cost, £1 17s. 6d. p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *
White Mustard, 12 lb. per acre. Cost, 10s. p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *
Serradella, 16 lb. per acre. Cost, 13s. 4d p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *
Partridge Peas, 150 lb per acre. Cost, 18s. 9d. p.a.	* * *	* * *	* * *	* * *	* * *	* * *	* * *

The trees (*) are 18 ft. apart. With the exception of strip No. 7, the whole area was dressed with lime at the rate of 1 ton per acre.

On 29th March the orchard was double-disked, and on the following day lime (costing £1 17s. 6d. per ton) was applied at the rate of 1 ton per acre. This was worked in with another stroke of the disks on the following day. On 3rd April the seeds and manures enumerated above were applied broadcast and harrowed in. No rain fell till 28th April, but the subsequent winter was unusually wet.

RESULTS.

The following notes, made when inspecting the crops on 18th September, indicate the results of the test :—

Crimson clover was found generally to be a good take, and over 1 in. high. Where it crossed the strip dressed with manure No. 2 it was a better colour and had more growth than with manure No. 1, the growth and colour again being poorer on No. 3, poorer still on No. 4, and still less again on No. 5. On No. 6, while the colour and take were still good, the growth was very poor; on strip No. 7 (untreated) it was similar except for colour, which was poorer. The growth generally was good for the winter season. It would have been interesting to have been able to give the crimson clover another three or four months to complete its growth.

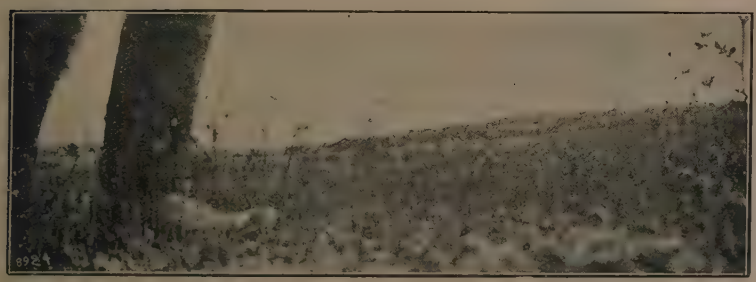
Common vetch, where it crossed strip No. 2, had decidedly more growth than on No. 1, and was slightly better still on No. 3. Quality considerably diminished on No. 4, and was slightly better again on No. 5. A marked falling-off in quantity was seen on No. 6, and still more so on No. 7. Everything considered, this experiment was not encouraging.

White lupin was well out in bloom over the full length of the sowing, up to 18 in. high; a good take; foliage ample, but colour a bit off. On the roots the nitrogenous nodules characteristic of the family of legumes were large and fairly numerous. No difference was noted in growth and condition of the lupins as between manures No. 1 and No. 2, but the crop was slightly better on No. 3, and better still on No. 4. It fell off again on No. 5, while on No. 6 it was only half the height of that on No. 5, and on No. 7 even less. This is a plant that will possibly be of great use for green-manuring on the Moutere lands.

Yellow lupin was generally about 6 in. high, just coming into flower. It was a good take, with foliage of a deep-green colour, but required another month to bring it to maturity. No difference was noted between the effect of manures No. 1 and No. 2, but No. 3 resulted in considerably more growth and blossom. These were still better on No. 4, rather less on No. 5, and only half the growth on No. 6. Colour and take were still good on the untreated strip, but growth was even less than on No. 6.

PLOUGHING IN WHITE MUSTARD ON MANURE NO. 2.

WHITE MUSTARD ON MANURE NO. 3.



WHITE MUSTARD ON LAND DRESSED WITH LIME ONLY (NO. 6).

WHITE LUPIN ON UNTREATED LAND (NO. 7).

WHITE LUPIN ON MANURE NO. 4.

WHITE LUPIN ON LAND DRESSED WITH LIME ONLY (NO. 6).

White mustard was generally 3 ft. or 4 ft. high, the blossom being about over. It is interesting to note that growth on No. 2 manure was shorter by 1 ft. than that on No. 1. On No. 3 the crop was at its maximum, both in height and quantity of foliage. On No. 4 it was practically the same. On No. 5 manure there was a drop of about 1 ft. in height, but a sturdy well-furnished growth, while on No. 6 the growth and take were poor and the crop of no practical use. On No. 7 (the untreated plot) the crop was even worse, though it should be mentioned that the land just there was rather a steep clay outcrop.

Serradella over all manure strips had taken well and made about 1 in. of growth. A few months of warm weather is required to bring this crop to maturity.

Partridge peas had made a poor take and were very irregular in growth. Some plants were up to 9 in. high and just coming into blossom, but nowhere were they of any practical use.

OUTSTANDING FEATURES.

The plants that stood out as being of special promise for the purposes of green-manuring on the Moutere Hills, under the conditions of the test, were white lupin and white mustard. Of the five manures used, No. 3 was the most successful, under the conditions indicated, in producing a maximum growth. In reviewing the test a special note should be taken of the difference between the limed and manured section as compared with the untreated strip. The latter gave practically no results whatever.

The cost per acre of these experiments (in seed and manures) is somewhat high, but allowance must be made for increased cost of material owing to the war. It is intended to continue the experiments with the object of arriving at something definite and practicable when prices again approach the normal.

Coconut-cake.—A correspondent having inquired as to the feeding-value of coconut-cake, which has been placed on the market by a New Zealand soapmaking concern, the following information was supplied by the Department's Chemist, Mr. B. C. Aston:—

Coconut-cake is the refuse from the soapmaking industry, in which the coconut-oil is used to supply the fatty acids. Before the oil is expressed the dried pulp (the copra or fleshy portion of the coconut) contains 65 per cent. of oil. The refuse cake is composed of water 10·5, crude protein 21·4, crude fat 8·5, nitrogen-free extract substances 38·7, crude fibre 14·7, ash 6·2 per cent. This cake is readily eaten by farm-animals. In Europe it is preferred to feed it to dairy stock. About 4 lb. per head per day may be given. The butter and bacon from animals fed on coconut-cake tend to be harder, and in this respect resemble those from animals fed on palm-nut cake.

ARSENIC-SPRAYING FOR BLACKBERRY PEST.

THE spray method of treatment bids fair to counter the blackberry menace, furnishing an effective and comparatively inexpensive weapon of destruction — of especial value where other methods, such as ploughing and cultivation, are impracticable or inexpedient. Remarkable success with arsenic solution as the spraying-material has been attained in several localities. Mr. Allen M. Williams, of Te Aute Station, Pukehou, Hawke's Bay, has kindly furnished the following account of his method and experience :—

In reference to our treatment of blackberries, we first cleared the stock out of the paddock and then sprayed the blackberries with 2 oz. arsenic to the gallon of water. When the bushes had quite dried off say, in a month—we burnt them. The man in charge of the work would then go to each bush twice a week to spray the young shoots as they appeared. In our soil (limestone subsoil) after the first week or two it would only require looking at once a week, and gradually ease off until no more shoots appeared. The point is not to let the young shoots get into leaf. The best time to spray is when the blackberries are in flower and the sap well up. If one is careful not to let the young shoots get into leaf the stock can be put back into the paddock after the blackberries have been burnt, including any grass which may have been affected by the poison. We have always done this and never lost a hoof. All our blackberries were absolutely destroyed in a very short time, but in lighter soils I can quite understand that it might take much longer. Do not cut the blackberry bushes down, but spray them as they stand.

OTHER METHODS OF BLACKBERRY-CONTROL.

A Nelson district settler sends the following note :—

This wretched blackberry causes enormous expense to struggling farmers on newly burned bush areas which cannot be ploughed for some years. One remedy is to subdivide the sections and heavily stock alternate paddocks with strong hardy two-year-old Shorthorn cattle ; but they must have free access to a constant supply of drinking-water —this being absolutely necessary. Another effective remedy is to sow the common fern on the blackberry areas. Let it grow up two years and thicken ; this chokes the weed clean out, as blackberries require more moisture than fern, and fern dries all the moisture out of the soil. The fern can easily be got rid of in a dry spell with a good wind and running fire. Then sow again with good mixtures. Where the conditions allow of cultivation one ploughing will kill blackberries if the surface is first well cleaned off, the furrow cut square, and turned *clean over, upside down*, and not disturbed with too much harrowing. Apply fertilizer liberally to thicken the grass quickly.

ABERDEEN-ANGUS CATTLE.

THE EXPORTATIONS TO AUSTRALIA.

J. R. MACDONALD.

DURING the month of November £6,000 worth of Aberdeen-Angus stud bulls and heifers left New Zealand for Queensland in five shipments. Ninety-one of the animals came from the Gisborne district and fifteen from Hawke's Bay. The shipments were undertaken by Mr. John Moir, representing a leading firm of stock and station agents of Brisbane. The consignment is the third lot of cattle of this breed taken from New Zealand by Mr. Moir, who twelve months ago secured fifty head, and previous to that a smaller number.

The demand for the Aberdeen-Angus in Queensland has arisen from the fact that during the late droughts in that State it has unmistakably shown its superiority over all other breeds in hardiness or ability to resist the tax of such conditions. The breed has a reputation for hardiness, acquired in its original quarters, the north-east of Scotland, and the quality appears to as readily exhibit itself in respect to drought-resistance as to other circumstances.

The particular animals now referred to go to the Darling Downs, but their progeny will spread out to various parts of Queensland, and it is expected by many that in time the breed will become the leading one of the northern State. The Darling Downs district, as a rule, has a satisfactory rainfall, and the quality of the land is superior, but occasional droughts cause trouble and losses, and to minimize such the Aberdeen-Angus is being introduced. So popularly regarded for the purpose is the breed that yearling store stock in Queensland have lately come to command £1 10s. per head more than those of any other sort, and three-year-olds fetch £3 per head more. The latter fact implies the progress the animals make under prevailing Queensland conditions and the regarded superiority of the breed's beef qualities as the animals get nearer the butcher's block. The Aberdeen-Angus, although essentially a breed to do well under unfavourable conditions, is also capable of growing a superior beef-weight to any other animal on first-class pastures. It is, however, such a neat and small-boned animal that its weight

does not look the same to the average or lay eye; but the scales prove it. It carries more flesh on the ribs and rump than do other breeds, and the carcase consists of less coarse fat and waste—the latter being a corollary of the former. The animal, in fact, has a conjunction of valuable qualities, ability to forage and ability to lay on flesh.

The demand is everywhere growing rapidly for young or "baby" beef throughout the world, and it is held by supporters of the Aberdeen-Angus breed that it fills the requirements for such somewhat better than other breeds. The large quantity of beef that has been exported from New Zealand to England during the last year or two has intensified the demand for this class of meat in the Dominion, and recent droughts in Australia depleting herds below normal have had a similar effect in the Commonwealth. In competitions held in England and America it has been proved that the Aberdeen-Angus at from yearling stage upwards weighs heavier than other breeds, and no matter what the age is the weight appears in the right parts of the carcase.

These are points well worthy of the consideration of those who would become interested in the breed. Every breed of animal is subjected to the like and dislike criticisms of fanciers, and a considerable injustice has been done to the Aberdeen-Angus in Australia and New Zealand in the past through failure to recognize that the animal weighs heavier than it looks, and that it will prosper and make condition where other breeds may receive a check. The eye is often a deceptive judge of the intrinsic value of an animal, and thus colour, length of leg, and larger belly development in other breeds have gained votaries for the latter to the neglect of the beef utility and absence of waste of the Aberdeen-Angus. Another factor that has stood in the light of the breed is that the animal grown under conditions necessitating an exhibition of its hardiness is afterwards unfairly compared with other breeds born and bred upon rich pastures. Given good conditions from the start of its life, however, the Aberdeen-Angus will, as stated, compare favourably with any other breed.

The object now aimed at in breeding the Aberdeen-Angus is to get a squarer, deeper, and heavier back-end than heretofore. This places still more flesh on the valuable parts of the carcase. It is preferred in the modern animal to have a softer tail-head and deeper flank.

There is every prospect of these exportations from New Zealand being followed by others. A constant and greater stream of all kinds of New Zealand stud stock to supply deficiencies in Australian flocks and herds is likely to occur, and it is important that care should be taken to safeguard the industry. All un-

reasonable impediments should be removed. Easy transportation arrangements and favourable shipping accommodation, assuring health and comfort, are essential. In the case of cattle the the carrying boats should arrange for an ample and ready supply of water, the matter of food-supplies being attended to by those in charge of the stock.

POULTRY-FEEDING TESTS AT MILTON.

IT will be recalled that a twelve-months feeding-test was recently carried out at the Department's Milton Poultry-station, the final results being recorded in the *Journal* for May and reviewed in the June issue. The birds used in that demonstration are being continued in a further year's test with another scheme of dietary. The object of

PEN NO. 4, BROWN LEGHORNS.

the previous test was to decide whether the yield of eggs could be profitably maintained by substituting lucerne chaff and oats for wheat, but retaining pollard. That this could be done was clearly demonstrated, the results being beyond expectations. In the present test, as will be seen from the particulars appended, both pollard and wheat have been entirely eliminated from the dietary of pen No. 4, lucerne-meal and oats being substituted. No. 2 pen receives wheat but no pollard. Six months of the test have now expired, and the

results so far are extremely interesting, but as they are inconclusive it has been decided to defer the publication of details until the completion of the test. It may, however, interest poultry-keeping readers to know that the leading pen at the half-year was No. 4, Brown Leghorns, which finished second in the previous test, with 1,449 eggs for the year. For the present six months this pen has produced 619 eggs, which even with egg-laying competition rations would be considered a good average for birds in their second year. From the point of view of the experiment this is distinctly instructive. The scheme of dietary of the current test is as follows:—

Pen No. 1 (6 White Leghorns): Pollard, bran, maize, meatmeal, wheat.

Pen No. 2 (6 Brown Leghorns): Lucerne-meal, bran, maize, meatmeal, wheat.

Pen No. 3 (6 White Leghorns): Pollard, bran, maize, meatmeal, oats, lucerne-chaff.

Pen No. 4 (6 Brown Leghorns): Lucerne-meal, bran, maize, meatmeal, oats.

—*F. C. Brown, Chief Poultry Instructor.*

PLUM-WINE RECIPES.

Dry Wine.—Place plums in a copper or enamel jam-making bowl and cover with water. Boil, and when boiling simmer for half an hour; strain into wooden vessels (casks for preference). Add ½ lb. to ¾ lb. of good sugar to each gallon of liquid and allow to ferment until dry—*i.e.*, when all the sugar has disappeared. Let stand for seven days, then rack the clear off into another vessel and allow to stand for another fortnight. Then rack again and bung the cask up airtight. The wine will be ready for use in from three to six months.

Sweet Wine.—Proceed as in the making of dry plum-wine, but when adding sugar add ½ lb. per day per gallon of juice until 5 lb. per gallon have been added; then allow to ferment. When fermentation is completed, if not sweet enough, add more sugar until the wine is sufficiently sweet to be palatable. Then add 4 oz. of potassium bisulphide per 100 gallons and 7 gallons of grape-spirit—7 gallons grape-spirit from 40 o.p. (overproof) to 65 o.p. to be used to every 100 gallons of liquid. Ready for use in six to nine months.

By a Commonwealth Proclamation of September, 1916, the Proclamation of February last in regard to the importation into Australia of citrus plants has been repealed, and the importation of citrus plants (including citrus fru ts) is prohibited from any part of the world in which the disease citrus-canker or Japanese canker exists. An exception is made in the case of the American States of California and Arizona, subject to certain specified conditions, including that of an official certificate that the consignment is free from citrus-canker and from all other diseases.

LUCERNE IN SOUTHLAND.

LUCERNE is still so comparatively little known in Southland that the experience recounted below should be informative to many farmers (dairymen especially) in that great all-round agricultural section of the Dominion. In a letter to Mr. W. J. McCulloch, Fields Supervisor, Invercargill, Mr. J. D. Hopkins, of "Holmwood," Wyndham, writes :—

I sowed an acre of lucerne according to the Department's scheme on 1st November, 1912, and herein give my experience of lucerne-growing in Southland, together with the benefits, in my opinion, of this odder crop to the dairy-farmer.

The plot was divided into four sub-plots : (1) Control-plot—no lime and no inoculated soil ; (2) lime only at the rate of 1,500 lb. per acre ; (3) lime 1,500 lb. and inoculated soil 300 lb. per acre ; (4) inoculated so l only at the rate of 300 lb. per acre.

The results have been such as indicate that inoculation is necessary on my land, for plots 1 and 2, which were not so treated, failed entirely and were eventually ploughed up. At first plot 3 appeared slightly better than plot 4, showing a difference apparently in favour of the addition of lime, but later on and at present no difference can be detected. My conclusion is that inoculation is essential, but that lime has little, if any, effect here

The first cut of the remaining half-acre was made on 1st February, 1913, just three months from sowing, and this was left to act as a mulch. This first cutting tends to make the plant throw out a greater number of fresh shoots from the crown. The second cut was made in May of the same season, after which date the crop attained a further 12 in. in height, but this was left as a protection during winter. Each season since, four or five cuts have been taken off the half-acre—six spring-dray loads at each cutting. In 1913–14 one cutting was made into hay, the other cuttings being carted out to the cows and fed to them at night. So far I have not willingly attempted to graze the stand, but during last winter I had stock in the same field, and as the lucerne was not fenced they grazed the patch rather bare, with the result that I consider I have lost a cut this season.

From my short experience I am confident that lucerne can be successfully grown in Southland if properly treated, one of the chief points being to select land clean and free from weeds and give occasional intercultivation To enable the latter operations to be carried out the seed should be sown in rows on the flat. I have at time of writing completed sowing a further 5 acres, all in rows, at the rate of 15 lb. per acre. For some years I have been growing oats, peas, vetches, and grass for green-soiling purposes, but I believe that lucerne will prove the best crop for my purpose. The cows eat it greedily and milk well on it. I may mention that the subsoil of my land is of a free open nature.

WORK FOR THE COMING MONTH.

THE ORCHARD.

J. A. CAMPBELL, Assistant Director, Horticulture Division.

JANUARY is one of the busiest months with the fruitgrower, particularly if his orchard is a mixed one. The stone-fruit season is at its height, and to successfully handle the different varieties as they come in, at the same time attending to other necessary work, such as spraying, cultivation, &c., means long and busy days for the grower.

The earlier varieties of pip-fruits are also coming in, marking the opening of the pip-fruit season. Although at the present time such fruits are rarely grown in large quantities as compared with the later sorts, time must be found for handling those produced.

With the exception of a few districts the prospects of a heavy crop of pip-fruits, especially apples, are not so bright as indicated earlier in the season. An unusually heavy dropping of young fruit has been reported from many districts; this is no doubt due to imperfect pollination, as a result of unfavourable weather at the time of blossoming, combined with the exceptionally wet period which followed.

These unfavourable weather conditions are also responsible for additional troubles to the orchardist in the form of fungus diseases. Such diseases are reported to be, and no doubt are, far more prevalent than they have been for some time past.

FUNGOID DISEASES.—CONTROL OF BLACK-SPOT.

During the past few seasons the weather generally has not been conducive to fungus diseases, and, with the exception of a few districts, moderate precautionary measures have been sufficient to ensure comparatively clean crops. These conditions have had the effect of somewhat lessening the orchardist's respect for destructive diseases such as black-spot, and as a result there are many instances in which the precautionary measures necessary under the conditions experienced this season to guard against attacks have not been fully attended to. Moreover, owing to the humidity of the atmosphere, black-spot has not been kept

wholly within bounds in all cases even where reasonable precautionary measures were carried out.

Although the experienced orchardist is no doubt well aware of the treatment necessary for black-spot, it may be as well, while the affected fruit is still in evidence, to repeat for the benefit of those not so well informed the minimum treatment required.

All apple and pear trees should be sprayed either with copper-sulphate solution at the rate of 1 lb. to 10 gallons of water during July or August, or with 8-6-40 Bordeaux mixture just as the buds begin to swell. Spraying should be repeated when the cluster-buds burst and show colour, or the most advanced burst into bloom — pears with 6-4-50 Bordeaux, or lime-sulphur 1–20; apples with 3-4-40 Bordeaux, or lime-sulphur 1–30.

Much depends on this treatment as well as upon the thoroughness with which the work is carried out. One feature is practically as important as the other, and the same applies throughout the whole scheme of disease-control. No spray, however good it may be, will give any real satisfaction unless thoroughly applied at a high pressure, and in most cases the higher the pressure the better.

Subsequent spraying for black-spot should be confined as much as possible to the lime-sulphur solution, except in cases where the disease has got a hold on the fruit, in which case it may then be necessary to resort to Bordeaux mixture, but the latter spray should not be used as a summer dressing on apples where it can be avoided, owing to the russeting effect it has on many varieties.

The above-mentioned ingredients are used for fungus-control generally, and, as far as winter treatment is concerned, are applied in much the same manner, but reduced in strength as required for the different classes of fruit.

Dealing further with fungus-control, it must be remembered that many of these organisms hibernate on the fallen foliage and decayed fruit of the previous season. An orchard, therefore, should be cultivated and old foliage well turned under, or the land sown down in a cover-crop. Old foliage and mummified fruit should also be picked from the trees and destroyed.

CODLIN-MOTH, POWDERY MILDEW, AND SOFT-BODIED INSECTS AFFECTING PIP-FRUITS.

For the control of the above spray with a combined solution of lime-sulphur and arsenate of lead at the rate of 1 gallon of lime-sulphur to 100 to 120 gallons of water, with 3 lb. to 4 lb. arsenate-of-lead paste added. Repeat at intervals of not more

than three weeks. Three and a half to four pints of "Black Leaf 40" can with advantage be added to the above for woolly aphis.

In connection with the lime-sulphur and arsenate-of-lead combination there are certain points to be observed, as follows: (1) Add the lime-sulphur to the major portion of the water first; mix the arsenate in the remainder of the water and add to the lime-sulphur mixture. (2.) Do not let the mixture stand about after the combination is made, but apply as soon after this has been done as possible, otherwise the danger of foliage-scorching will be increased. (3.) Lime-sulphur alone or in combination with arsenate of lead is quite an effective spray, but its action on the foliage is somewhat erratic. In the North Island 1–80 or even stronger can often be used without damage, and at other times anything stronger than 1–100 will seriously scorch the foliage; while in parts of the South Island 1–120 or even a weaker mixture is liable at times to damage both fruit and foliage. Therefore lime-sulphur should be carefully prepared, and applied with a fair amount of discretion for a time.

RIPE OR BROWN ROT (MONILIA FRUCTIGENA).

This disease, as affecting stone-fruits, was described by Mr. A. B. Mansfield, Orchard Instructor, Auckland, in the March, 1916, issue of the *Journal*. In appearance and effect the disease is well known in many parts of the Dominion, particularly in connection with stone-fruits. For the past three or four years the trouble has been active in the Hawke's Bay District, while heavy damage was done to the stone-fruit crops in the Auckland District last season. The disease is particularly destructive of Japanese plums and nectarines, while pip-fruits, particularly apples, are in nowise immune from attacks. Last season the keeping-qualities of many of the apples grown in the Nelson District were seriously affected in this way.

In districts where ripe-rot is prevalent it is advisable, in addition to the winter and early spring treatment, to spray stone-fruits with a fungicide during the early summer and apples just prior to picking. The object is to prevent the spread of the disease from infected to non-infected fruit; therefore any fruits at all affected should be picked and destroyed. Infection is likely to take place at any time during the season, but more particularly as the fruit reaches maturity and commences to ripen. Care should be taken to retain the stalk on the fruit, so as not to puncture the skin when picking, as injuries of this kind allow the entry of the spores of the disease, which readily become active

when confined in the close atmosphere of the packed case. Lime-sulphur is the summer treatment recommended, and can be used at the rate of 1–125 for peaches, and from 1–100 or 120 for apples.

CULTIVATION.

During the summer months the soil should be kept well cultivated, both to retain the moisture essential to the welfare of the tree and the maturing of the fruit crop, as well as to destroy all weeds, which not only rob the soil of moisture, but, if allowed to seed, will greatly increase the weed trouble in the future.

THE POULTRY-RUN.

F. C. BROWN, Chief Poultry Instructor.

On most plants in the country some culling can now be done to advantage. While the general culling of hens should not take place until March, good weeding-out work can be carried out in January. Now that the cost of foodstuffs is steadily soaring up it should be remembered that every bird that fails to show a profit over the cost of production is a continual drain on profits. Consequently there should be no sentiment or delay in culling out doubtful stock. All overfat hens of the drone type, and those that give evidence of possessing a weak constitution, should be got rid of at once. The person who is not a keen student of laying form, however, is very apt to cull out the wrong bird, and it is therefore essential that the work of culling at this season of the year be carried out with considerable judgment. For instance, it will generally be found that the heaviest layers have the most worn appearance, and are the thinnest birds in the flock, while, on the other hand, the heaviest and best-looking birds are the drones. During visits to poultry salerooms the writer frequently notices some of the best-laying types in the country being marketed, this being due entirely to their rough appearance, and ignorance on the part of the owners in not knowing that the apparent worse-for-wear condition of the birds was solely due to heavy egg-production. Poultry-keepers lacking in experience in culling, and desirous of assistance, are reminded that the services of the Department's Poultry Instructors are available for this purpose.

In the case of surplus cockerels there should be no delay in culling out all the birds that have reached the age of four and a half months.

Now that the breeding season is over the breeding males should be separated from the females. When table eggs only are wanted male birds are not necessary or desirable. More eggs will be produced without them; moreover, infertile eggs will preserve better.

SIDE-LINE POULTRY-KEEPING.

Poultry-keeping is one of the lesser rural industries which no small settler on the land should neglect. The large quantities of eggs annually imported to meet the local demand, the high prices ruling for both eggs and table poultry, together with the increased cost of living at the present time, should not only make poultry-keeping appeal to the smaller settler, but also impress on suburban residents who have available waste land and spare time the expediency of paying more attention to, and if possible increasing, their poultry stock. There are many of this class of land occupiers who by keeping a fair number of fowls of the high-class laying type, managed on proper lines, would greatly assist in maintaining their own food-supply. They would also be in a position to dispose of their surplus production, and thereby add to their money-earning power. Viewed as it should be, as a properly conducted side-line on the small holding, poultry-keeping can be made an important wealth-creating medium. At the present time hardly a farm is without its few fowls, while the majority of suburban residents have their little flock. Unfortunately, however, in many cases the stock is of the wrong kind, and the management is not what it should be. With high-class laying-stock now available from the Department's poultry-stations and elsewhere at a moderate price, and the services of expert officers for free advice on any feature of the industry, there is no valid excuse if poultry do not give a handsome profit over the cost of their keep.

The first essential in making poultry-keeping pay is to have the right class of stock—not necessarily any particular breed of fowls, but rather a good laying-strain of a popular breed. There are good and bad laying-strains in all breeds. The most popular breeds at the present time are the White Leghorns for heavy egg-production, and the Black Orpington or White Plymouth Rock as general-purpose breeds. It is, however, one thing to secure a good laying-strain of birds and another thing to maintain their high egg-yielding capacity, whether it be on the farm or the suburban holding. It is always an unwise policy to set eggs from the whole of a general flock. A breeding-pen by means of which only eggs of the very best birds are used for reproductive purposes is essential. As is the case with the progressive breeder of dairy stock,

the up-to-date poultry-keeper must know the productive capacity of the animal for the entire year before he is satisfied as to its breeding-value. Instead of breeding indiscriminately, the practical poultryman uses in his breeding-pen tested birds only. Of course, he attaches due importance to constitution—the fundamental factor in breeding profitable poultry stock—and, having secured his desired type, he sees to it that the management is correct in every detail. At one time it was the general opinion that the old barnyard fowl was the most profitable to keep, but not so now. The records established at the egg-laying competitions, which have been given so much publicity, should be sufficient to convince farmers and others that it will not pay to keep anything in the shape of a mongrel hen, but that tested purebred birds must be the foundation of the stock. It would have been unbelievable only a few years back that a flock of, say, a hundred pullets would produce an average of over two hundred eggs per bird in a year. It would have also been thought impossible that any six hens should lay 1,699 eggs in a year, or an average of 283 per bird. This world's record was put up at an egg-laying competition in Victoria. It is questionable if the best pen of barnyard fowls in the land would lay a half or even a quarter of this number, and then they would produce them in the cheap season.

It is to be hoped that before long more consideration will be given to the special all-purpose breeds, such as typified by the six Black Orpingtons which put up the fine record of 1,411 eggs for the year in a recent egg-laying test at Christchurch. In successful poultry-keeping egg-production must be the chief objective, but consideration must be given to the table-poultry side of the industry if the maximum results are to be secured from the undertaking. The special general-purpose breeds provide a really good table carcase, as well as being such good layers. It is only when more attention is given to these dual-purpose breeds, and they are sold by weight, that the table branch of the poultry industry will be placed on a sound footing. At the present time the great bulk of the stock that reaches the market is unsatisfactory, being undersized and in poor condition. The few good birds that come to hand are realizing such exceptionally big prices that they can only be considered as a luxury.

Given the right class of stock the next important matter to attend to is proper housing. No matter how good the stock may be they cannot produce their maximum (artificially stimulated) egg-yield unless they are properly protected from extreme weather conditions. The object of the poultry-keeper should be to have his birds laying in other than the natural laying season for bird-

life. It is the winter-produced egg that returns the highest profit above the cost of producing it. A good supply of dear eggs can only be assured by depending on the pullets, and providing them with dry, roomy quarters at such a time. All that is required is a simple lean-to building with the front partly open and covered with wire netting. The amount of open space allowed in front must depend on the depth of the house, and also on the local weather conditions. It is always a mistake to make a house too shallow, the reason being that it cannot be sufficiently opened up in front to admit of the maximum of sunlight and at the same time prevent the wind and rain from beating on the birds. It must also be remembered that the cost of one deep house is much less than that of two narrow ones, and the former will accommodate over double the number of birds and to much better advantage. In a general way the dimensions of houses for small numbers of fowls may be given as follows: For fifty birds, 15 ft. deep by 12 ft. wide; for twenty-five birds, 12 ft. deep by 8 ft. wide; for twelve birds, 10 ft. deep by 6 ft. wide. No fowlhouse should be less than 7 ft. high in front and 5 ft. 6 in. at the back. Convenience of attending to the birds should be taken into consideration when building the house. In order to maintain the floor in a perfectly dry condition the foundation or wall-plate should be at least 6 in. to 8 in. above the ground-level, and the inside filled up with well-rammed earth, covered with tar and sand or concrete.

Having secured the right type of birds, and accommodated them in a proper house, the next important factor is correct feeding. The food should be of good quality, and an ample supply provided. Neglecting to give the high-type layer all the food it will eat is one of the chief weaknesses in poultry-keeping to-day. The heavy egg-producer cannot be overfed, providing the food is of the right quality. It should be obvious to any one that a bird of the size of the domestic fowl, producing day after day 2 oz. eggs containing one of the most highly concentrated products known, must have the necessary material with which to make them, and at the same time have a surplus to maintain the great bodily vigour demanded of her. When small numbers of fowls are being kept the table-scraps generally form the bulk of the morning meal. Dried off with pollard and bran these make a perfect meal for poultry. To secure the best results, however, animal food such as meat or its substitutes must be supplied in addition. Where meat is available it should be fed separately at midday in the proportion of 1 oz. (cooked) to each bird per day. Where meatmeal has to be depended upon this should be fed separately in a hopper or similar receptacle, so that the birds may be given an opportunity to balance their own ration. The practice

frequently followed of mixing this highly concentrated material in the mash, and thus often compelling the birds to eat a greater proportion of it than nature demands in order to secure a meal, is a common cause of ovarian troubles. For the evening meal a mixture of good sound wheat, plump oats, and maize may be supplied. No hard-and-fast rule can be laid down as to the amount of food required by a flock of fowls. Their appetites vary according to the weather and their laying-condition. They must be fed according to their appetite. They eat what they want, and what they eat is usually what they require. Green food is always a necessary item for maintaining healthy and vigorous stock. It also has the effect of giving the yolk a good rich colour. There is nothing better as a green food for fowls than chaffed lucerne, clover, or watercress. Some of the best-looking and best-doing flocks to be found in the Dominion receive nothing else in the form of green stuff than watercress. Sharp gravel-grit, crushed oyster-shell, and also clean water should always be available to the birds, while cleanliness and constant warfare against vermin should never be overlooked. Shade, especially for the growing stock, is essential at this season of the year.

THE APIARY.

E. A. EARP, Apiary Instructor.

AFTER-SWARMS.

THE beekeeper should give some little attention to the prevention of after-swarms. These swarms are a nuisance, and weaken the parent hive without being of much value in themselves. If the colonies are left undisturbed they will swarm freely, and all chance of a surplus is lost. Among the many plans practised for their control the most successful is that which provides for removing the parent hive. This method is an excellent one, and will usually prevent the issue of the small swarms. As soon as the swarm is hived remove the parent hive to a new location in the apiary, and put the swarm on the old stand. The effect of this change is to strengthen the swarm with the field-bees which are absent gathering nectar, and correspondingly to temporarily weaken the old hive, so that it will rarely put out a second swarm. The emerging bees in the parent colony will soon provide sufficient workers to ensure a surplus, and the tendency to swarm will not be as prevalent. In order to make the operation more successful

the parent colony should be examined for queen-cells, and they should all be removed save two.

After-swarms should always be returned to the parent colony, unless the beekeeper requires them for increase. In the latter case it is a good plan to dump two or three swarms together, and thus form a strong colony that will gather sufficient stores to carry on through the winter. In dumping shake the swarms on to an excluder placed between the supers, so as to take out the young queens. Before returning an after-swarm overhaul the parent hive and cut out all the queen-cells. Place two or three empty combs or frames fitted with sheets of foundation in the brood-chamber, and put the brood over an excluder to hatch out. In case the colony contains a virgin queen, the combs, before being placed over the excluder, should be shaken in front of the hive to make sure that the virgin queen is not confined above the excluder, or she will not get mated, and a drone-raising colony will be the result. A good plan at all times is to provide an opening for the bees between the super and the brood-chamber, which can be done by inserting a small block of wood immediately under the edge of the super. This will allow the bees to fly freely, and in case the virgin queen is by accident confined to the super an opportunity will be given her to fly and get mated. Likewise the drones can pass out of the super. If on making a later examination the queen is discovered in the super, she can be placed in the brood-chamber under the excluder.

FOUL-BROOD.

As advised last month, beekeepers should not fail to treat diseased colonies where found. This work should be carried out in advance of the main flow, so that the beekeeper's undivided attention may be given to securing a crop. Over and over again the treatment of disease is delayed until such time as the season is advanced, and as a result the affected colonies do not count as producers in the main crop; whereas if treatment is carried out as soon as nectar is being freely secreted these colonies will be in good heart to produce a surplus. When the beekeeper is in doubt as to the presence of disease it is advisable to forward a sample of the comb to the Director of the Horticulture Division, Wellington, or to the Apiary Instructor for his district, for examination.

QUEEN-EXCLUDERS.

The season is at hand when it is advantageous to use queen-excluders. During the height of brood-rearing, and in order not to cramp the queen, she should be allowed the full use of the

super, so that large numbers of worker bees may be raised to work the main crop. It is not wise to bring the excluders into use too early, and never until such time as the bees are working freely in the super. By cramping the queen fewer bees are produced, and small returns will be netted. Every encouragement must be given to the queen to lay to her utmost, and by so doing populous colonies will be produced. The best time to put the excluders on the hives is when the main flow sets in and the bees are busy bringing in the nectar. Too many beekeepers make the mistake of putting on the excluders when the supers are first placed on the hives, and it is not an easy matter to get the bees to work in the supers even if combs of honey are raised from the brood-chamber, as excluders tend to make the passage between the lower story and the upper more difficult for the bees. Before placing on the excluders make a careful examination of the colony to note its condition, and to take stock of the number of frames of brood in the hive. If the brood-chamber is full of brood the combs may be manipulated so as to provide the queen with ample room for laying during the period which follows. The best plan is to place the majority of frames of capped brood over the excluder, and to substitute empty combs, taking care to see that the queen is confined below. As the bees hatch out over the excluder they will become accustomed to passing through it, and as fast as the cells become vacant they will be filled with honey. If eggs are raised with the brood care must be taken to see that the bees do not raise queen-cells, for in the latter case the hive may swarm out, leaving one or more virgins in the top story, and these queens, being confined to the hive, cannot get out to be mated, and will eventually develop into drone-layers. Within one week after raising the brood examine the combs in the super to note if any queen-cells have been raised. If any are found they must be destroyed. The advantage of the use of queen-excluders is in saving labour at the time of extracting, by doing away with the work of picking over the combs. Much time is lost in this operation, and extracting is retarded when everything should be hurried. It is only by the use of excluders that bee-escapes can be employed, and in many seasons, depending largely on the weather, these have to be brought into use.

TREATMENT OF SWARMS.—PROVISION OF SUPERS.

There is a little doubt in the minds of many of the beekeepers who have been accustomed to box hives as to the surplus to be obtained from a swarm. It is not uncommon to find swarms put into frame hives and not provided with room for surplus. Unless

supers are given to strong early swarms from ten to fifteen days after they are established these colonies will often swarm again, and no surplus will be obtained. It must be understood that the season plays an important part in the returns netted, but large amounts are yearly lost through the beekeeper neglecting to give ample room for the swarm to store honey. When a swarm has been established a few days a hurried examination should be made to note progress, and from this the beekeeper will be able to form some idea as to the time at which the super will be required. An instance came under my notice last season where a beekeeper sold £8 worth of honey taken from an early swarm, while in the same district many beekeepers complained that the season had been poor. An examination of their hives revealed the fact that the early swarms had not been provided with room. Nothing works so well as a swarm under proper treatment, and the attention given in providing supers will amply repay the beekeeper.

QUEEN-REARING.

In last month's notes attention was directed to queen-rearing. Every effort should be made to requeen the apiary during the working season, so that the colonies will go into winter quarters headed by a good queen. It often happens that the beekeeper is dissatisfied with his stock, in which case his best plan is to send direct to some reliable breeder and secure a number of good queens. Whether this suggestion is carried out or not, when raising queens the beekeeper should select the best stocks in his apiary; in other words, queens should be raised from queens whose bees have a record as honey-producers.

HONEY-HOUSE.

Section 14, subsection (*d*), of the regulations under the Sale of Food and Drugs Act provides that "every place used for or in connection with the sale, manufacture, preparation, storage, or packing of any food for sale shall, so far as practicable, be used for that purpose only; and no place shall be so used which is at any time used as a sleeping-apartment, or in which any animal is allowed to be, or which is or has been used for any purpose which would be likely to contaminate such food or injuriously affect its wholesomeness or cleanliness." It is quite clear from this what is required of the beekeeper in dealing with honey as an article of food. The producer should remember at all times that, as honey is not subjected to heat to destroy foreign matter before being consumed, too much care cannot be observed in its preparation. The extracting-room should be kept scrupulously clean, and the

utensils should receive the same care and attention as are necessary in a dairy.

A good extracting-house is an important adjunct to every well-equipped apiary, and unless special attention is paid to the building the tedious work of extracting and bottling the honey will cause the beekeeper a good deal of anxiety during the working season. Perhaps no set plan can be given for the size of a honey-house, and it may be left to the individual beekeeper to erect one to suit his needs. However, it is highly important that ample room should be provided for extracting and bottling the honey, also for storing spare supers during the winter months. Too many beekeepers err in not providing enough space, and extracting operations are consequently hampered, and the work of handling the crop is increased.

In addition to plenty of space, good ventilation should be provided. See that the windows and doors are well screened, to prevent the entrance of bees, which are liable to become a nuisance during operations. A good plan is to hang the windows on pivots so that they will swing from the centres, thus allowing them to be revolved. Where the windows are fixed it is essential that bee-escapes be used, so that as the bees crawl up the window-frames they will pass through the small holes in the escapes. Suitable escapes can be purchased, or cones may be made of fine gauze and these attached to the screens on the windows.

Where bees are kept in small numbers the question of economy may have to be considered, but it is poor policy to work without a certain amount of convenience. The advantages of working in a roomy, cool, well-ventilated, bee-proof house are many, and the question of expense should not deter the beekeeper from providing the best extracting-house possible.

THE FARM GARDEN.

W. H. TAYLOR, Manager, Arataki Horticultural Station.

VEGETABLE-CULTURE.—SOME PESTS.

We have this spring, for the first time in my experience, had aphis trouble with carrots. It was observed that the carrots ceased to grow, and shortly assumed a reddish-yellow appearance, and examination showed them to be completely covered with the small green aphis. The plot was treated with XL-All liquid insecticide, applied through the rose of a watering-pot, at a strength of 1 in 40, according to directions, and the cure was sudden and effectual.

I remember many years ago having the same trouble with celery, but we had less knowledge of insecticides in those days, and had not such easily applied remedies. I tried kerosene emulsion, and killed both aphis and plants. Clift's Fluid and Vistolene are as effectual remedies as XL-All, as I have proved when treating other plants. Cabbages, Brussels sprouts, and kindred plants are sometimes attacked by a rather large grey-coloured aphis. Boiling water is the best thing to use for this pest. Provide means for boiling the water near the patch. Protect your hands by wrapping them in canvas, add a little common soap to the water, and apply forcibly with a garden syringe. As the water passes through the air, it is not boiling when it reaches the plants. I have found this to be an all-sufficient remedy for this class of aphis.

Slugs are troublesome in summer-time only when cultivation of the soil is neglected, or when they are provided with congenial shelter, such as is afforded by strong pea-haulm lying on the ground, or ground well covered by strong cabbage-leaves. When the soil can be frequently stirred there need be no trouble with slugs during the hot months. This affords a strong argument in favour of providing peas with sticks, as then the hoe can be used along the rows. Snails are best disposed of by picking them up.

The caterpillar of the diamond-backed moth, which attacks all the cabbage tribe, is most difficult to deal with. No remedy will avail against a strong attack unless the plants can be kept growing, therefore the first steps taken should be in the direction of stimulating growth. When the plants are first attacked give a dressing of nitrate of soda to the soil; 2 oz. per square yard will be sufficient. If this is followed by a good flooding of water there will be an immediate acceleration of growth unless the soil is poor, in which case some blood-and-bone manure should be also given—an ounce or so more than of the nitrate. Tar-water has proved to be a valuable preventive, but not every one can find time to apply it. Remember that the vital point in a cabbage-plant (and this holds good of all the brassica family) is the heart of the plant. It is from here that growth is made; if the tiny heart-leaves are destroyed the plant cannot grow, and these are the leaves which are attacked first. I have found that hellebore powder dusted into the heart of the plant will save it, provided, as remarked above, that the plant is made to grow. If the plant does not make good growth the insects constantly attack the same spot, and the repeated attacks eventually destroy the plant; but if fair growth is made the plant can bear a little mutilation without showing much injury. Tar-water is made by boiling ½ lb. of perfectly fresh coal-tar in about 2 gallons of water until it is all dissolved, stirring all the time. The water should boil before the tar is added, or it will be

very difficult to get it to dissolve. The quantity may be made up to 20 gallons by adding cold water. Thoroughly drench all the leaves with the liquid, and also the surrounding soil; it is the smell of the tar that is wanted, this being disliked by the moth, which will not lay its eggs on such tainted plants. Those who can obtain the ammoniacal liquor that is sometimes allowed to run to waste at the gas-house will find this more valuable than the tar-water. This liquid is, on account of the ammonia it contains, a valuable manure. The smell of tar is as strong as in the case of tar-water. The liquid, used as it comes from the gas-house, would kill all vegetation, but diluted with twelve times its bulk of water it becomes a powerful manure.

There remain woodlice. Frequent scuffling the soil will go far towards banishing these pests: they do not like to be disturbed. Take care to leave no crannies in the soil for them to harbour in. Poultry of all kinds eat them greedily. Either ducks or hens will soon rid a place of woodlice.

French-beans should be sown. Butter-beans are best for the warmer parts of the Dominion, being more delicate in flavour than the green kinds; but they are not so hardy as the others and do not succeed in the colder localities. Crops should be kept closely gathered. If all are not wanted for use gather them just the same, for if allowed to form beans in the pod they quickly exhaust the plants, cutting the crop short. The same remarks apply equally to peas, which also may be sown. From about the last week in December till the end of January all the brassica tribe should be planted. These include cabbage, broccoli, savoys, and the various kales. Cauliflowers of Autumn Giant strain should be out by Christmas, so that they may come in at Easter-time, when they are much appreciated, as the choicer vegetables are getting past. The time for planting naturally varies somewhat in different districts. Speaking generally, South Island districts and the cooler parts of the North Island may be classed together. Planting of the brassica tribe for winter use should be completed by the middle of January. In the warmer parts, including the Manawatu and Lower Hutt, where the days of sunshine are long, planting can be done several weeks later, but should not extend far into February. Red cabbages should be planted at once. Celery-planting should now be largely done. Sow and plant lettuces.

Marrows, pumpkins, &c., make at first very strong runners; these runners show flowers and fruit; the latter, however, usually fall off, which puzzles many people. It is quite natural and right for the fruit to fall. The plant is establishing itself, and spending its energies on growth, for the purpose of getting a good stock

of roots to support fruit in due course. The fruit is borne on side shoots; the early formation of these is secured by pinching out the tips of the runners, and fruit soon follows.

SMALL FRUITS.

Loganberries.—This fruit is becoming increasingly popular in England. According to English horticultural papers many large plantations are in bearing there, and appear to be highly satisfactory. There is no apparent reason why the fruit should not be as successfully cultivated in New Zealand. The most prolific plants I have so far seen have been those grown on walls. This is but natural, as the growth is under more complete control than the plants are when trained to wires or stakes. The habit of the plant is to throw up very long suckers, and these should be allowed to extend as far as they will. The following winter the suckers are to be laid in for fruiting. The rods should not be shortened beyond cutting off the immature growth at the end; this may mean cutting away several feet of thin growth. From every bud on the rods lateral growths are made, exactly in the manner of climbing roses, and it is these lateral shoots that bear the fruit. The stronger the rods (provided they are well ripened), the larger the bunches of fruit should be. The same rod will bear fruit two years. If kept for fruiting a second time the laterals that bore fruit should be cut back to about two buds. So far as I know they will not fruit a third time. It is not usual to fruit a rod a second time, being done only when there are not enough new rods made. The first season after planting there is nothing to do but encourage growth. The next winter if growth has not been very strong it is best to cut back all growth to near the starting-point: this will cause stronger growth to be made. In open-ground cultivation, for supporting the rods wire trellises are required; stakes are useless for the purpose, as it is necessary to keep the rods apart and open to sun and air.

THE FLOWER-GARDEN.

During the summer months good cultivation is more beneficial to plants than superficial watering. Without doubt watering during very dry weather is a great help to plants, but it must be thorough if it is to do good, and not be given too often. A thorough soaking once or twice would do good, whereas driblets every day would be productive of harm. Where the soil is fairly good, and has been properly prepared by trenching, the plants will usually do very well without watering, provided the surface soil is kept loose.

Keep the soil above clumps of bulbs loose so as to prevent cracking, which is bad for the bulbs in several ways. It is a good plan to place an inch or two of sand over the clumps. The sand prevents cracking, and serves to mark the spot, and also keep it clean, as few weeds will grow on the sand. Some bulbs remain dormant in the soil all the summer and until the autumn rains start them again. These include ixias, sparaxis, tritonias, and others. Such may be lifted without injury at this time. There should, however, be caution about lifting narcissi, some of which, the polyanthus varieties in particular, are never really dormant if left in the soil. Such kinds should be lifted before the foliage is quite dead, for if left till it is dead it will be found that they have made new roots. When that has happened it would in ordinary circumstances be best to leave them alone. Narcissi should be lifted about every third year, as the natural increase of the bulbs causes them to become crowded. They should not be lifted without reason, as the first year from planting is seldom their best.

When freesias are lifted they should not be kept long exposed to the air. Place them in a box after drying, and cover them with dry sand. If any readers of these notes should be growing freesias in pots, they may have had an experience that was not uncommon when freesias were new, that of the bulbs remaining dormant a whole year — *i.e.*, they missed growing one year and grew the following year. That was the result of keeping them out of the ground too long, or, rather, leaving them exposed to the air. The correct way to deal with bulbs grown in pots is as follows: When the foliage is dead remove the pots to a dry place: a frame or a shelf in a greenhouse, where the sun will bake them, is best. Leave them in that position till the end of February, when it will be time to think about starting them again. Now turn the pots into a riddle, sort the bulbs, and select the largest for potting. Place about ten or a dozen bulbs in a 5 in. pot. Stand the pots in a frame and give them a very thorough watering; then cover the frame with sacking and give no more water till the bulbs push through the soil, after which expose them to light and water as needed. The small bulbs may be planted out; they soon reach flowering state.

In an ordinary way the present may be regarded as the slack season. There is no need to sow anything, though if desired plants of perennial or biennial nature may be sown. For general purposes, however, six or eight weeks hence will be early enough to start, and as the weather will then be less hot, seed-raising under glass will be attended with less labour. Outdoor seed-sowing is now out of the question.

ANSWERS TO CORRESPONDENTS.

IN every instance a question to which an answer is desired in these columns must be accompanied by the full name and the postal address of the inquirer, not necessarily for publication, but as a guarantee of good faith. The question should be written on one side of the paper only.

MILK-TESTING SAMPLES.

"INQUIRER," Pahiatua:—

Kindly inform me whether it is possible by using caustic soda to get an accurate test of milk which has curdled; also whether milk tested every eleven days will give as true a test as would a weekly test.

The Dairy Division:—

It is inadvisable to add caustic soda to a curdled sample of milk, as strictly accurate results cannot be expected by this method. The testing of curdled samples at any time is not recommended, but of course the result obtained by the addition of soda would not be far out, providing the amount of the latter used is taken into consideration.

As regards the length of time which samples may be kept for testing, the usual custom at dairy factories in New Zealand at present is to test on the 10th, 20th, and last days of each month. When there are thirty-one days in the month it is noticed that there is practically no difference in the result of the test with the older samples, provided that sufficient preservative has been used to keep the milk in good order.

COW-POX IN DAIRY HERD.

"COW-POX," Awanui:—

Would you please inform me of the best method of treating cow-pox in a herd of dairy cows. How long is it likely to last?

The Live-stock Division:—

No treatment can cut short the condition in the early stages of cow-pox. The disease runs its course within relatively fixed periods according to the development of the pustules, the dried crusts generally separating after the twentieth day. The crusts in bad cases might be dressed with a little boracic ointment. The milk should be removed with a teat-siphon if the hand causes much irritation. See that the siphon is kept thoroughly clean and boiled for five minutes before insertion. It is better to isolate the cow or, at any rate, milk her last, so as to prevent the disease spreading to other cattle; also wash your hands in some disinfectant solution, and take care you do not get vaccinated yourself.

BLOOD AS A FERTILIZER.

J. PRESTON, Lyttelton:—

Kindly tell me whether pure fresh blood from an abattoir would be beneficial to an ordinary vegetable, flower, and fruit garden, and what amount should be applied to, say, 1 square yard. Also, would this manure alone be sufficient for the ground, which is light, on a hillside facing south? Climatic conditions are dry and hot.

The Horticulture Division :—

Fresh blood would be suitable for the purpose indicated, although, as the nitrogen-content of blood is moderately slow-acting, its full benefit would not be available unless applied some time prior to planting. An even dressing of 3 cwt. to 3½ cwt. per acre should be sufficient. The site and conditions described suggest the advisability of applying a certain amount of stable manure, or the raising and turning-in of a legume, such as white lupin.

NON-FRUITING OF CHERRY-TREES.

H. D. BRUCE, Otoko :—

Please advise me why some of my cherry-trees after having had a lot of blossom should fail to set the fruit. The flowers just wither up and leave the bare stalk.

The Horticulture Division :—

If the failure to set applies to this season only, it may be due to unfavourable climatic conditions during the period of blossoming. On the other hand, the trees may be affected by either cherry-leaf-scorch or brown-rot. These are both fungus diseases, and the same remedy applies to both—namely, spray thoroughly with 8-6-40 Bordeaux mixture as soon as the foliage falls and again as the buds begin to swell. Cut away all affected parts and destroy all old foliage during the winter.

HOME-PRESERVED BUTTER.

R. H. D., Mangoihe, via Raetihi :—

Please advise me of a simple yet effective method of putting down (preserving) butter to last, say, eight months. We do not use a separator. We have tried both dry salt and brine in an earthenware jar, but think our method must have been at fault, although we were very particular to wash the butter clean. What effect will temperature have on the butter in making or keeping after being made ? Ours is a very damp climate, and, except for a month or so in summer, generally cold.

The Dairy Division :—

It is practically impossible to keep butter in a sound condition for eight months unless it be placed in a freezing-chamber and held at a very low temperature. Even under such conditions a certain amount of deterioration usually takes place. If every care is taken in handling the cream and churning it at a low temperature, hand-made butter may be stored at an ordinary temperature with fairly good results, providing from ¾ oz. to 1 oz. of salt to each pound of butter is used and a small amount of butter-preservative added to the butter along with the salt. The butter should be packed so as to exclude the air as far as possible, and stored in a cool place.

TREATMENT OF BLOWN COW.

ERNEST PEACH, Port Levy :—

Please inform me of the best first-aid treatment for cows that have been blown on white clover.

The Live-stock Division :—

The following drench (to be obtained from a chemist) should be given in the first stages of a cow that has been "blown": Ol. Lini, 1½ pints; Sp. Ammon. Co., 1 oz.; Carbo. Lign., 1 oz. If the animal is too far gone to be drenched she should be punctured with a trocar and canula on the left side, and at equal distance between the hip-bone, last rib, and end of short ribs. After the gases have ceased to escape the hole must be covered with a pitch-plaster. This is usually done the next day.

SKIM-MILK CHEESE.

F. B. WHITE, Glenham, Southland:—

Kindly inform me how many pounds of skim-milk it takes to make 1 lb. of cheese.

The Dairy Division:—

The quantity depends mainly, of course, upon the amount of casein in the milk, and the amount of unavoidable loss which takes place in the process of manufacture. About 25 lb. of skim-milk would be required to make 1 lb. of cheese. It may be mentioned that skim-milk cheese has little or no sale in New Zealand, neither is it suitable for export, as such cheese dries out very quickly and becomes almost unsaleable.

TROUBLE IN LAMBS AFTER DOCKING.

"RUNHOLDER," Kaikoura:—

A fair percentage of my lambs of both sexes become stiff in the hind quarters about a week after marking. Several die, some recover, and others remain permanently impaired. I am satisfied the operation was in no way the cause. Can you give a reason and suggest a cure?

The Live-stock Division:—

The symptoms given in your letter are not sufficient to determine a definite diagnosis. The complaint is either a rheumatic condition or it is due to septic contamination while docking. The former trouble has been prevalent in the North Island for the last two seasons, and cases have been seen at Blenheim quite recently. The lambs may be affected before or after docking, and show stiffness of the hind quarters, or one limb only may be affected. Although very stiff when roused, they can generally evade being caught in the paddock. The trouble is due to dietetic and climatic conditions, and by changing the ewes into another paddock where the feed is less succulent the lambs soon recover and show no deleterious effect. As a general rule the complaint does not cause any mortality.

SEPTIC METRITIS IN COW.

A. W. HEAD, Maungatautari:—

Is there any cure for paralysis in cows? I had a two-year-old heifer which had twins in September. Apparently she was all right for twelve days; then she went down with paralysis in her hind quarters. I kept her alive for a month, but she was then so weak and miserable and getting so low that I had to have her destroyed.

The Live-stock Division:—

The heifer apparently was affected with septic metritis, a condition due to a septic condition of the womb. The germ gains access to the uterus shortly after calving and while the neck of the womb is open. Preventive measures should be adopted in all newly calved cows. The womb should be syringed out with a mercuric chloride tabloid mixed in three whisky-bottles of water within twenty-four to thirty hours after calving. The Department's bulletin on contagious abortion has been sent you, wherein you will see directions for irrigating the womb. The treatment for a cow suffering from the complaint is to irrigate the passage with one tabloid mixed in two whisky-bottles of water, and give an aperient drench as follows: Epsom salts ½ lb., ground ginger 2 teaspoonfuls, mixed in a quart of gruel or water. Stimulants, such as whisky, should also be given every four hours if required. A cow may be affected with this complaint at any time from eight days to five months after calving—that is to say, if the germ is present immediately after calving.

NOTE.—"Malvern," Heriot, has omitted to furnish his name, and an answer to his inquiry cannot be given until the name is received.—ED.

SYLLABUS FOR DEGREE OF BACHELOR IN AGRICULTURE.

THE Board of Studies of the University of New Zealand decided at its recent sitting in Wellington to recommend to the University Senate an amended syllabus for the degree of Bachelor in Agriculture. The object of the change is to make the studies bear more closely on practical farming. The courses prescribed in the more practical of the subjects are as follows:—

Agriculture.

The Soil.—Formation and classification; characteristics of soil and subsoil; indication of good and bad soil. Physical properties of soil; texture; porosity; retentivity; movement of water in soils.

Permanent Improvement of Soil.—Drainage advantages and metohds in detail; irrigation; burning; cultivation. Principles underlying cultural operations; effects of good and bad cultivation in detail.

Lime and its uses; various kinds of lime; application, &c.

Manures.—Principles of manuring; farmyard manures; green-manuring; artificial manures, their purchase, use, and application.

Rotation and systems of farming.

Seeds.—Various means of raising seeds; selection and purchase of seeds.

Crops.—Consideration in detail of preparation of seed-bed; seeding; manuring; time to sow; harvesting; feeding; economic importance of all our farm crops.

Grasses.—Economic importance of all the grasses and clovers found in New Zealand pastures—selection and seeding for particular classes of soil and for various agricultural purposes.

Permanent Pastures.—Management and treatment.

Hay and ensilage making.

Live-stock.—Various breeds of horses, cattle, sheep, and pigs; economic importance of each breed.

Principles of Breeding.—Feeding and management.

Foods.—Their use and purchase.

Wool.—Characteristics of wool; of different breeds of sheep; qualities and values; wool-classing; preparation of wool for sale.

Dairying.—Conditions and suitable soil; breeds of cattle suitable for dairying, their feeding and management; milk records and testing; dairy-management.

Farm-management; systems of farming, grazing, and tillage; mixed farming; dairying; selection of a farm; points to be considered.

Veterinary Surgery and Hygiene.

A. The elementary anatomy and physiology of the animal body. The horse is taken as a type, the important differences in the organs of the other domesticated animals pointed out.

B. Definition of disease; methods of diagnosis and the elements of bacteriology in relation to disease. The causes, symptoms, and treatment of the common diseases of the horse, sheep, and ox.

Description of the following disease processes: Inflammation, suppuration, ulceration, gangrene, necrosis, caries, rickets. Description of wounds and fractures, and cysts. The surgical treatment of the common diseases of the head, limbs, and feet. The use of the common therapeutic preparations.

Agricultural Chemistry.

Soils.—The origin and classification of soils; their physical, chemical, and biological characters; soil-water and soil-atmosphere; soil-analysis and its interpretation.

Plants. — The more important organic constituents of plants and their economic importance; composition of plant-ash; the nature and mode of utilization of the various ingredients of mineral plant-food.

Manures.—General principles of manuring; preparation, composition, and chemical characters of the chief phosphatic, nitrogenous, and potassic fertilizers; the mixing of manures; the agricultural chemistry of lime and lime compounds. The elementary chemistry of insecticides, germicides, and weed-killers.

Feeding-stuffs.—The chemical nature of the constituents of animal-food and the uses of each in animal nutrition; heat and energy values of foods; albuminoid ratio; rations for maintenance, for fattening, and for milk-production; the food value and chemical nature of the constituents of the common roots, forage crops, and cereals; milling and malting by-products.

Dairy Chemistry.—Constituents of milk, cream, butter, cheese. Chemistry of butter and cheese making. Estimation of fat and water in dairy-produce; adulteration of milk, and methods of detection.

A candidate in agricultural chemistry will be required to forward to the Registrar, before the examination, a certificate from a teacher in the subject in an affiliated institution that he has attended a course in practical chemistry based upon the above syllabus to the satisfaction of the teacher and has passed a practical examination in the subject.

Surveying and Levelling.

Surveying; plotting; making plans; calculating areas with special reference to farm surveys; levelling for drains, races, &c.; calculation of quantities of embankments, walls, cuttings, &c

FORTHCOMING AGRICULTURAL SHOWS.

Helensville A. and P. Association: At Helensville, 29th January.
Woodville A. and P. Association: At Woodville, 31st January.
Feilding Industrial A. and P. Association: At Feilding, 6th and 7th February.
Central A. and P. Association: At Waipukurau, 7th February.
Opotiki A. and P. Association: At Opotiki, 8th February.
Pahiatua-Akitio A. and P. Association: At Pahiatua, 9th February.
Dannevirke A. and P. Association: At Dannevirke, 14th, 15th, and 16th February.
Hukerenui Agricultural Association: At Towai, 15th February.
Te Puke A. and P. Association: At Te Puke, 15th February.
Northern Suburban A. and H. Assn.: At Takapuna, 16th and 17th February.
Northern Wairoa A. and P. Association: At Mititai, 17th February.
Masterton A. and P. Association: At Masterton, 20th and 21st February.
Rangitikei A. and P. Association: At Taihape, 28th February.
Taranaki Agricultural Society: At New Plymouth, 28th February and 1st March.
Hawke's Bay A. and P. Association: Autumn Show at Hastings, 6th and 7th March.
North Kaipara A. and P. Association: At Paparoa, 7th March.
Ashburton A. and P. Association: At Ashburton, 14th and 15th March.
Temuka and Geraldine A. and P. Association: At Temuka, 22nd March.
Oxford A. and P. Association: At Oxford, 12th April.

(A. & P. Association secretaries are invited to supply particulars of their show dates.)

The Auckland Branding Registration District (under the Live-stock Act has been reconstituted and now comprises the counties of Rodney, Waitemata, Eden, Manukau, Franklin, Coromandel, and Great Barrier Island, also including all boroughs and town districts in or adjacent to that area.

IMPERIAL GOVERNMENT MEAT-SUPPLIES.

THE new agreement between the Government, the meat-producers, and the freezing companies under the meat-purchase scheme is embodied in the following notice issued by the Hon. W. D. S. MacDonald, Minister in Charge of the Imperial Government Supply Department, under date Wellington, 23rd November, 1916 :—

The amended arrangements for the f.o.b. purchase on behalf of the Imperial Government of all meat available for export are as follows :—

The conditions laid down in the Right Hon. the Prime Minister's notice published in the *Gazette* of 3rd March, 1915, page 725, remain unaltered, except in respect of the following points,—

1. The classification of the meat, and the price to be paid therefor, f.o.b., will now be—

No.	Description.	Prices now in Operation.
		d.
1	Wethers, first quality, 72 lb. and under	5⅜
2	,, ,, over 72 lb. and up to 85 lb.	5½
2A	,, ,, over 85 lb. and up to 98 lb. (subject to special approval by the Inspector)	4⅞
3	,, second quality	5⅛
4	Ewes, first quality, 72 lb. and under	4⅞
5	,, ,, over 72 lb. and up to 85 lb.	4⅝
6	,, second quality	4⅝
7	Lamb, specially prime and Canterbury quality, 42 lb. and under	6½
8	,, first quality, 42 lb. and under	6⅜
9	,, ,, over 42 lb.	6⅛
10	,, second quality	6⅛
11	Beef, prime ox	5
12	,, second and heifer	4¾
13	,, boning in quarters	4¼
14	,, cow, prime	4¾
15	,, ,, second	4¼
16	,, boneless	5¼
17	Mutton, legs	6⅜
18	,, shoulders	5⅜
19	,, loins	5⅜

2. These prices are fixed for the period of the war, and for at least three months after its termination.

3. These prices apply to all meat from stock slaughtered on or after 20th October, 1916, and which is available for export.

4. Storage charges* are reduced by 25 per cent. as from 1st November, 1916. They will therefore now be as follows : No storage shall be payable until after one month has expired, when the rate shall be $\frac{5}{32}$d. per pound per calendar month or any portion of a month, but the total storage for any period shall not exceed $\frac{5}{32}$d. per pound.

* Paid by Government.—ED.

Lyons Sample Fair.—The French Vice-Consul for New Zealand advises that a sample fair will be held at Lyons, France, from 1st to 15th March next, on similar lines to those of last year's fair at that place. The fair will again be open not only to foreign buyers, but also to the manufacturers of the Allies and neutral countries.

AREA PLANTED IN COMMERCIAL ORCHARDS.

FOLLOWING are the estimated areas planted in commercial orchards in the Dominion during the 1916 planting season. The districts quoted correspond to those of the Orchard Instructors of the Horticulture Division, by whom the estimates are compiled.

District.	Area in Acres.	District.	Area in Acres.
Whangarei	100	Taranaki and Wanganui ..	5
Auckland (North)	200	Nelson	1,325
Auckland (South)	50	Marlborough	100
Poverty Bay	20	North Canterbury	100
Waikato and Bay of Plenty ..	25	South Canterbury	30
Hawke's Bay	75	Otago and Southland	300
Manawatu and Wairarapa ..	60	Total area planted, 2,390 acres.	

STOCK EXPORTED.

THE following table shows the numbers and descriptions of stock exported from the Dominion during the month of November, 1916:—

Port of Shipment.	Horses.		Sheep.			Cattle.		Pigs.	
	To Australia.	To Eastern Pacific.	To Australia.	To Eastern Pacific.	To San Francisco.	To Australia.	To Eastern Pacific.	To Eastern Pacific.	To Australia.
Auckland ..	..	22	..	250	..	..	31	37	..
Gisborne ..	..	..	..	..	..	72	..	..	..
Napier ..	3	..	..	..	..	..	..	..	..
Totals ..	3	22	..	250	..	72	31	37	..

The following are particulars of horses shipped: Draught, 1 gelding, 1 mare; thoroughbred, 3 fillies; hacks, 20.

STOCK IN QUARANTINE.

THE following stock was received into quarantine during the month of November, 1916:—

No.	Description.	Sex.	Port of Origin.	Owner or Agent.	Address.
		MOTUIHI ISLAND (AUCKLAND).			
1	Pomeranian bitch	Female	London ..	Miss Humphries ..	Auckland.
1	Rough-coated sheep-dog	,,	,, ..	Miss P. R. Taylor	,,
1	1 cattle-dog ..	Male ..	Sydney ..	W. L. Matthews ..	Kennedy's Bay.
1	,, ..	Female	,, ..	,, ..	,,
		SOMES ISLAND (WELLINGTON).			
1	Shorthorn bull ..	Male ..	London ..	H. Wilson ..	Bull's.
		QUAIL ISLAND (LYTTELTON).			
2	Suffolk Down rams	Male ..	London ..	George Gould ..	Christchurch.

LONDON MARKET VALUES.

COMPARATIVE STATEMENT COMPILED FROM THE HIGH COMMISSIONER'S CABLES FOR THE PAST THREE MONTHS.

London Date.	Wool. Bradford Quotations for Tops. 36's.	40's.	14's.	50's.	56's.	60's.	Mutton. Canterbury.	Mutton. North Island.	Lamb. Canterbury.	Lamb. Other than Canterbury.	Beef. New Zealand Hinds.	Beef. New Zealand Fores.	Butter. Danish.	Butter. New Zealand.	Cheese. New Zealand White.	Cheese. New Zealand Coloured.	Cheese. Canadian.	Hemp (Spot). New Zealand Good-fair.	Hemp (Spot). New Zealand Fair.	Hemp (Spot). Manila Fair (New Grade).	Hemp (Forward Shipment). New Zealand Good-fair.	Hemp (Forward Shipment). New Zealand Fair.	Hemp (Forward Shipment). Manila Fair (New Grade).	Wheat. N.Z. Short-berried.	Wheat. N.Z. Long-berried.	Oats. N.Z. Sparrowbills.	Oats. N.Z. Danish.
1916.							d.	d.	d.	d.	d.	d.															
Sept. 11	..	..	..	..	..	..	*8⅜	..	*9½	..	..	..	196/0	186/10	104/0	104/0	..	49/10/0	47/10/0	51/10/0	48/10/0	48/10/0	50/10/0	..	..	..	..
,, 16	..	..	..	..	..	..	*8⅜	..	*9½	..	5½	4½	197/0	187/0	105/0	105/0	105/0	49/10/0	47/10/0	52/0/0	49/0/0	47/0/0	51/0/0	..	..	..	..
,, 23	..	..	..	..	..	..	*8⅜	..	*9½	..	..	..	202/0	191/0	105/0	105/0	106/0	50/0/0	48/0/0	52/0/0	49/10/0	47/10/0	51/10/0	..	..	..	..
,, 30	..	..	..	..	..	..	*8⅜	..	*9½	..	..	..	207/0	200/0	107/0	107/0	108/0	50/0/0	48/0/0	52/0/0	49/10/0	47/0/0	..	..	..	..	..
Oct. 7	..	..	..	..	..	..	*8⅜	..	*9½	..	6½	5½	211/0	198/6	109/0	109/0	111/0	50/0/0	48/0/0	52/0/0	49/10/0	47/0/0	51/10/0	..	..	*33/0	..
,, 14	..	..	..	..	..	..	*8⅜	..	*9½	..	†7½	†6½	210/0	199/0	111/0	111/0	113/0	50/10/0	48/10/0	52/10/0	50/0/0	48/0/0	52/0/0	..	..	*34/6	..
,, 21	..	..	..	..	..	..	*8⅜	..	*9	..	†7½	†6½	208/0	197/0	111/0	111/0	113/0	52/10/0	50/0/0	54/0/0	52/0/0	50/0/0	53/10/0	..	..	*36/6	..
,, 28	..	..	..	..	..	..	*8⅜	..	*9½	..	..	..	212/0	199/0	112/6	112/6	115/0	53/0/0	51/0/0	54/0/0	52/10/0	50/10/0	53/10/0	..	..	*37/0	..
Nov. 4	..	..	..	..	..	..	*8⅜	..	*9½	..	‡7½	‡6½	216/0	202/0	113/6	..	115/0	53/0/0	51/0/0	54/10/0	52/0/0	50/0/0	53/10/0	*76/	..	*38/0	..
,, 11	..	..	..	..	..	..	*8⅜	..	*9½	..	7⅛	6½	217/0	203/0	..	..	118/0	53/0/0	51/0/0	54/10/0	52/0/0	50/0/0	53/10/0	..	..	*40/0	..
,, 18	..	..	..	..	..	..	*8⅜	..	*9½	..	..	..	216/0	..	..	..	122/0	53/0/0	51/0/0	55/0/0	52/0/0	50/0/0	54/0/0	..	..	*41/0	..
,, 25	..	..	..	..	..	..	*8⅜	..	*9½	..	7	6	219/0	..	..	..	127/0	53/0/0	51/0/0	56/10/0	52/0/0	50/10/0	56/0/0	..	..	*41/0	..
Dec. 2	..	..	..	..	..	..	*8⅜	..	*9½	..	7½	6½	219/0	..	..	..	127/0	54/0/0	52/0/0	58/0/0	53/0/0	51/0/0	57/0/0	..	..	*46/0	..
,, 9	..	..	..	..	..	..	*8⅜	..	*9½	..	7⅜	7¼	221/0	211/0	..	..	131/6	54/10/0	52/10/0	58/10/0	54/0/0	52/0/0	57/10/0	..	..	*48/0	..

NOTE.—The above beef quotations, unless otherwise specified, are for "N.Z. bull-beef." * Specified as "New Zealand." † N Z. cow-beef. ‡ N.Z. ox-beef.

NEW ZEALAND EXPORTS TO BRITAIN.

COMPILED FROM MANIFESTS OF VESSELS SAILED DURING RESPECTIVE MONTHS OF CURRENT AND PRECEDING SEASONS.

Month.		Mutton, Carcases.	Lamb, Carcases.	Beef, Quarters.	Pork, Carcases.	Butter, Boxes.	Cheese, Crates.	Wool, Bales.	Wheat, Sacks.	Oats, Sacks.	Rabbits, Crates.	Hemp, Bales.	Tow, Bales.	Kauri-gum, Pkgs.
January,	1916	106,700	295,170	41,726	179	108,593	101,917	92,849	..	..	..	7,438	1,666	1,218
,,	*1915*	*137,816*	*296,439*	*45,622*	*339*	*138,081*	*85,123*	*87,393*	..	..	*2,860*	*683*	..	*1,209*
February,	1916	170,973	266,414	29,056	23	96,096	84,740	96,016	..	..	..	8,161	1,804	1,900
,,	*1915*	*433,585*	*517,581*	*77,421*	*311*	*119,371*	*96,090*	*159,347*	..	..	..	*13,111*	*6,619*	*2,763*
March,	1916	327,977	363,269	83,725	..	59,671	62,082	49,750	..	..	474	2,666	637	1,247
,,	*1915*	*80,439*	*203,480*	*30,176*	..	*55,280*	*51,811*	*49,809*	..	..	..	*8,410*	*185*	*274*
April,	1916	108,488	195,707	106,369	..	24,703	81,652	41,725	..	..	..	3,782	337	450
,,	*1915*	*286,155*	*328,779*	*45,340*	..	*6,703*	*38,561*	*41,371*	..	..	*1,011*	*9,328*	*1,474*	*3,461*
May,	1916	170,164	282,156	134,971	..	26,789	56,961	26,356	..	..	1,000	2,892	235	731
,,	*1915*	*257,953*	*433,831*	*34,780*	*655*	*148*	*17,065*	*21,615*	..	..	*2,923*	*4,968*	*808*	*2,636*
June,	1916	138,303	290,319	41,593	..	10,289	18,463	22,998	..	..	5,439	5,260	2,076	1,219
,,	*1915*	*99,080*	*154,785*	*19,316*	*932*	..	*26,869*	*11,946*	..	..	*9,800*	*5,027*	*1,320*	*1,229*
July,	1916	367,827	593,670	42,322	..	4,209	30,940	50,804	..	..	10,950	9,244	3,720	3,230
,,	*1915*	*243,420*	*340,476*	*21,231*	*154*	..	*21,520*	*16,039*	..	..	*5,968*	*5,068*	*1,639*	*4,184*
August,	1916	238,926	266,390	76,755	..	9,810	32,178	18,713	3	..	9,725	7,463	1,868	3,293
,,	*1915*	*510,418*	*570,381*	*51,750*	*35*	..	*18,287*	*19,416*	..	..	*31,790*	*7,138*	*1,466*	*4,848*
September,	1916	272,848	163,852	75,422	..	185	..	6,786	7,421	..	23,445	4,494	2,428	1,123
,,	*1915*	*299,715*	*330,643*	*59,487*	..	*26,416*	*2,595*	*5,360*	..	..	*7,750*	*2,022*	*3,091*	*595*
October,	1916	190,290	132,429	60,670	..	50,667	34,459	11,600	12,596	..	11,599	8,417	5,786	2,138
,,	*1915*	*367,198*	*417,794*	*87,104*	..	*111,468*	*49,160*	*7,272*	..	..	*56,636*	*5,650*	*1,645*	*1,230*
November,	1916	168,447	218,660	26,301	..	123,181	60,277	11,772	..	..	11,495	8,571	3,523	3,953
,,	*1915*	*93,777*	*92,601*	*21,609*	..	*81,102*	*47,243*	*18,715*	..	..	*13,538*	*5,064*	*1,780*	*868*
December,	1915	91,124	59,231	36,467	..	214,967	81,939	33,527	..	..	3,052	6,016	1,940	5,555
,,	*1914*	*192,952*	*149,835*	*44,876*	..	*172,990*	*80,144*	*86,317*	..	..	*9,306*	*1,136*	*116*	*2,157*